SOIL SURVEY OF

Cache Valley Area, Utah

Parts of Cache and Box Elder Counties

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
Utah Agricultural Experiment Station

Issued November 1974

Major fieldwork for this soil survey was done in the period of 1959–64. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Utah Agricultural Experiment Station. It is part of the technical assistance furnished to the Blacksmith Fork and North Cache Soil Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

Locating Soils

All the soils of the Cache Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site, woodland suitability group, and wildlife suitability group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitations of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, range sites, and woodland suitability groups.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in the Cache Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "Additional Facts About the Cache Area" and also at the beginning of the publication.

Cover: **Sugar beets on Hendricks silt loam, 1 to 3 percent slopes. Wasatch Mountains are in the background.**

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Contents

Page
How this survey was made 1
General soil map 2
Moderately well drained to poorly drained soils of the low lake terraces 3
1. Logan-Salt Lake association 3
2. Trenton association 3
3. Greenson-Nibley-Collett association 3
Well-drained to somewhat poorly drained soils of the medium lake terraces 3
4. Kidman-Lewiston association 3
Well-drained soils of the medium and high lake terraces 4
5. Mendon-Avon association 4
6. Wheelon-Collinston association 4
7. Ricks-Timpanogos-Parleys association 4
Well-drained soils of the uplands 5
8. Nebeker-Hendricks association 5
9. Richmond-Sterling-Picayune association 5
Well-drained and somewhat excessively drained soils of the mountains 5
10. Yeates Hollow-Ant Flat-Goring association 5
11. Sheep Creek-Hoskin-Curtis Creek association 6
Well-drained and somewhat excessively drained soils of the high mountains 6
12. Agassiz association 6
13. Dateman-Agassiz-Bradshaw association 6
14. Lucky Star-Cluff-Bickmore association 7
Descriptions of the Soils 7
Agassiz series 7
Airport series 11
Ant Flat series 13
Avon series 14
Barfuss series 15
Battle Creek series 16
Bickmore series 17
Blackrock series 18
Bradshaw series 19
Cache series 20
Cardon series 20
Center Creek series 21
Clegg series 22
Cluff series 23
Collett series 24
Collinston series 24
Crookston series 25
Crowshaw series 26
Curtis Creek series 27
Dagor series 28
Dateman series 29
Datwyler series 30
Despain series 30
Elwood series 31
Elzinga series 33
Fitzgerald series 33
Flygare series 34
Foxol series 35
Goring series 35
Gravel pit 36
Green Canyon series 36
Greenson series 37
Hendricks series 39
Hiibner series 40
Hillfield series 41
Hoskin series 41
Hyrum series 43
Jordan series 44
Kidman series 45
Kirkham series 46

Page
Descriptions of the Soils—Continued
Lakewin series 47
LaPlatta series 48
Lasil series 49
Layton series 49
Leatham series 50
Lewiston series 50
Logan series 51
Lucky Star series 52
Maughan series 53
McMurdie series 54
Mendon series 56
Middle series 59
Millville series 59
Mixed alluvial land 60
Mult series 60
Munk series 61
Nebeker series 62
Nibley series 63
Obray series 64
Parleys series 65
Parlo series 66
Payson series 67
Picayune series 67
Poleline series 68
Preston series 69
Provo series 69
Quinney series 70
Red Spur series 71
Richmond series 72
Ricks series 73
Riverwash 74
Rock land 74
Roshe Springs series 75
Rough broken land 76
St. Marys series 76
Salt Lake series 77
Scave series 78
Scout series 79
Shay series 80
Sheep Creek series 80
Smarts series 82
Steed series 84
Sterling series 84
Stony alluvial land 85
Timpanogos series 85
Trenton series 87
Wheelon series 88
Winn series 89
Woods Cross series 90
Yeates Hollow series 91
Use and management of the soils for crops 92
General management for crops on irrigated soils 92
General management for crops on nonirrigated soils 94
Capability grouping 95
Management by capability units 96
Estimated yields 107
Use of the soils for range 110
Range sites and condition classes 110
Climatic zones and their effect on range 110
Descriptions of range sites 111
Use of the soils as woodland 116
Woodland management and woodland suitability groups 116
Use of the soils for wildlife 119
Kinds of wildlife and their habitat 120
Engineering uses of the soils 120
Engineering classification systems 121

CONTENTS

Engineering uses of the Soils—Continued
- Estimated engineering properties 121
- Engineering interpretations 166
- Engineering test data 167

Formation and classification of the soils 167
- Factors of soil formation 167
  - Parent material 167
  - Climate 168
  - Relief 169
  - Plants and animals 170
  - Time 171
- Classification of the soils 172

Laboratory analyses 175
- Methods of analysis 186

Additional facts about the Cache Area 186
- Industries 187
- Transportation 187
- Settlement and development 187
- Water supply 187
- Climate 188
- Farming 188

Literature cited 190

Glossary 190

Guide to mapping units ..... Following 192

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SOIL SURVEY OF CACHE VALLEY AREA, UTAH

PARTS OF CACHE AND BOX ELDER COUNTIES

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH THE UTAH AGRICULTURAL EXPERIMENT STATION

THE CACHE VALLEY AREA: PARTS OF CACHE AND BOX ELDER COUNTIES (called the Cache Area in this soil survey) is in the northern part of Utah and consists of about 813 square miles or 520,162 acres. It includes all of Cache County except about 230,000 acres of the Cache National Forest in the northeastern part of the county. It also includes about 17,000 acres of Box Elder County on the west slopes of Clarkston and Wellsville Mountains (fig. 1).

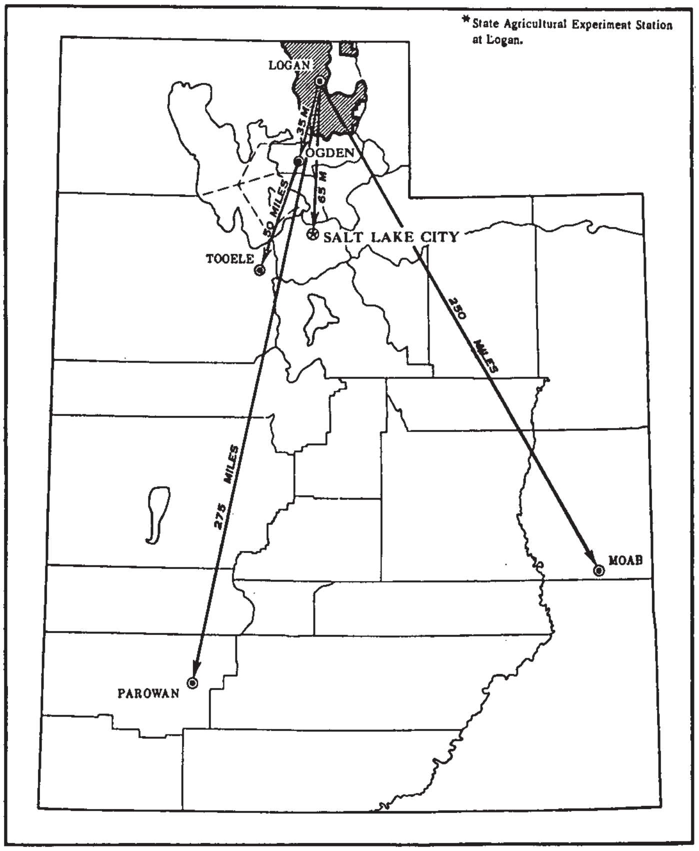

Figure 1.—Location of the Cache Valley Area in Utah.

This is an important farming area. It consists of about 123,000 acres of irrigated cropland, 116,525 acres of nonirrigated cropland or pasture, and 280,802 acres of range and woodland.

Cache County consists essentially of Cache Valley and its surrounding drainage area. Geologically, the valley is a graben at the eastern margin of the Basin and Range province between the northernmost element of the Wasatch Range, Wellsville Mountain, and the southern extension of the Malad Range. Clarkston Mountain is on the west, and the Bear River Range is on the east (*12*).[1]

The major part of the Cache Valley is at elevations between 4,400 and 5,200 feet. Height of the mountains included in the survey area ranges to nearly 10,000 feet.

The Bear River is the largest stream flowing into the survey area. It enters the valley from Idaho, west of Lewiston, Utah, runs south to the vicinity of Benson, then west into Box Elder County and into Great Salt Lake. The source of the Logan River is in the Franklin Basin. The Logan River enters Cache Valley east of the city of Logan. The source of the Little Bear River is in the extreme southern end of the county. The Blacksmith Fork River and its tributaries drain a large area from the east and southeast. Other smaller streams head in the mountains that border Cache Valley. The Bear River serves as a drainage for all these streams before it leaves Cache Valley toward Great Salt Lake. Most of the streams have cut deep channels through the lake terraces.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Cache Area, where they are located, and how they can be used. The soil scientists went into the survey area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

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[1] Italic numbers in parentheses refer to Literature Cited, p. 190.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in areas nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soils series* and the *soil phase* (*8*) are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Logan and Mendon, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Trenton silty clay loam, 2 to 4 percent slopes, is one of several phases within the Trenton series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of the Cache Area: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Airport-Salt Lake complex.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort needed for mapping them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Agassiz-Goring association is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Mixed alluvial land is a land type in the Cache Area.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Cache Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The 14 soil associations in the Cache Area are discussed in the following pages. For more detailed information about the individual soils in each association, refer to the detailed map and to the section "Descriptions of the Soils."

Moderately Well Drained to Poorly Drained Soils of the Low Lake Terraces

Soils of this group are moderately well drained to poorly drained, but they are dominantly somewhat poorly drained and poorly drained. They formed in mixed lake sediment and alluvium derived mainly from limestone, sandstone, and quartzite. These soils have a loam to silty clay subsoil. They are nearly level or gently sloping (slopes range from 0 to 3 percent) and are on low lake terraces and alluvial fans at elevations of 4,420 to 4,700 feet. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days.

Three of the associations in the Cache Area are in this group. They make up about 18 percent of the survey area.

1. *Logan-Salt Lake association*

Poorly drained, nearly level soils that have a silty clay loam and silty clay underlying layer

This association consists of soils on valley bottoms. It extends from southeast of Mendon to a point west of the city of Logan and southwest of Smithfield. The association makes up about 4 percent of the survey area.

Logan soils occupy about 40 percent of the association, and Salt Lake soils about 30 percent. Airport, Greenson, Cardon, and Collett soils and Salt Lake, gypsum variant, soils occupy the remaining 30 percent.

The Logan soils are poorly drained or very poorly drained, and they are strongly calcareous. The surface layer is silty clay loam that is black or very dark gray when moist. The material underlying the surface layer is silty clay loam and silty clay. The Salt Lake soils are poorly drained or very poorly drained, and they are very strongly calcareous. The surface layer is silty clay that is black or very dark gray when moist. The material underlying the surface layer is silty clay. The Airport, Collett, and Greenson soils generally are on slightly higher terraces than the other soils.

The soils of this association are used mainly for native pasture or for meadow from which hay is cut. The vegetation is mostly sedges, wiregrass, foxtail, and saltgrass, In the swales, where the water table is highest, there are cattails and bulrushes.

2. *Trenton association*

Strongly saline and alkali, somewhat poorly drained and moderately well drained, nearly level to sloping soils that have a silty clay subsoil.

This association is located in two areas. One of these is between the town of Richmond and the Bear River. The other area is between the towns of Benson and Petersboro, north nearly to the town of Trenton, with a narrow arm that extends as far as Cornish. The association makes up about 6 percent of the survey area.

Trenton soils are dominant in this association and occupy about 80 percent of the association. Cache, Jordan, Payson, and Lasil soils make up the remaining 20 percent. These soils generally are on lower terraces than the Trenton soils.

The Trenton soils are somewhat poorly drained and moderately well drained, and they are strongly affected by salt and alkali. The surface layer is silty clay loam, and the subsoil is silty clay.

Most areas of the Trenton soils in this association are cultivated. When irrigation water is available, alfalfa, small grain, sugar beets, and improved pasture are important crops. Dryland areas are used for alfalfa and small grain. Where these soils are not cultivated, the vegetation consists mainly of saltgrass, alkali sacaton, western wheatgrass, Great Basin wildrye, gumweed, sagebrush, and greasewood.

3. *Greenson-Nibley-Collett association*

Dominantly somewhat poorly drained, nearly level to gently sloping soils that have a loam to silty clay subsoil or underlying layer

This association is in areas near the towns of Wellsville, College Ward, and Hyrum and in a narrow band west of the cities of Logan, Smithfield, and Richmond that extends to the Idaho line. The association makes up about 8 percent of the survey area.

Greenson soils occupy about 40 percent of this association, Nibley soils about 30 percent, and Collett soils about 15 percent. Roshe Springs and Millville soils occupy the remaining 15 percent.

The Greenson soils are somewhat poorly drained and moderately well drained. They are loam or silt loam throughout. The Nibley and Collett soils are somewhat poorly drained. They have a silty clay loam surface layer and a heavy silty clay loam and silty clay subsoil.

The soils of this association are used mainly for irrigated crops of alfalfa, small grain, corn for silage, sugar beets, and improved pasture. Small areas are used for dryland crops of alfalfa and small grain. Where these soils are adequately drained, they are well suited to crops. Where the soils are not cultivated, the vegetation consists mainly of western wheatgrass, saltgrass, foxtail, alkali sacaton, and some areas of sedges and wiregrass.

Well-drained to Somewhat Poorly Drained Soils of the Medium Lake Terraces

Soils of this group are dominantly moderately well drained and somewhat poorly drained, but some are well drained. They have a fine sandy loam subsoil. These soils formed in mixed alluvium and lake sediment derived mainly from limestone, sandstone, and quartzite rocks. They are nearly level and gently sloping and are at elevations of 4,430 to 4,550 feet. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 50° F., and the frost-free season is 130 to 150 days.

Only one association in the Cache Area is in this group. It covers about 6 percent of the survey area.

4. *Kidman-Lewiston association*

Nearly level to gently sloping soils that are fine sandy loam throughout

This association is near the towns of Lewistown and Cornish and in the area south to the town of Benson. It makes up about 6 percent of the survey area.

Kidman soils occupy about 45 percent of the association, and Lewiston soils about 35 percent. Quinney, Layton, and Preston soils occupy the remaining 20 percent.

The Kidman soils are moderately well drained and well drained. The surface layer and subsoil are fine sandy loam. The Lewiston soils are somewhat poorly drained. The texture is fine sandy loam throughout. The water table is at a depth of about 20 to 40 inches. The subsoil and substratum of the Lewiston soils are strongly affected by salt and alkali.

The soils in this association are used for irrigated crops of alfalfa, small grain, sugar beets, corn for silage, and improved pasture. When the water table is controlled, these soils are well suited to crops. Where the soils are not cultivated, the vegetation consists mainly of bluebunch wheatgrass, western wheatgrass, foxtail, saltgrass, and sagebrush.

Well-drained Soils of the Medium and High Lake Terraces

Soils of this group are dominantly well drained and have a loam to silty clay subsoil. These soils are nearly level to very steep and occupy lake terraces, alluvial fans, deltas, and terrace escarpments. The Mendon, Avon, Wheelon, and Collinston soils formed in material derived from the Salt Lake geologic formation and contain an appreciable amount of volcanic ash. The Ricks, Timpanogos, Parleys, and McMurdie soils formed in mixed alluvium and lake sediment derived mainly from limestone, quartzite, and sandstone. Elevation ranges from about 4,500 to 5,300 feet. The average annual precipitation is 15 to 20 inches, the mean annual air temperature is 45° to 50° F., and the frost-free season is 110 to 160 days.

Three of the associations in the Cache Area are in this group. They make up about 19 percent of the survey area.

5. *Mendon-Avon association*

Nearly level to strongly sloping soils that have a clay loam and silty clay subsoil

This association is in three separate areas. The largest of these is near the towns of Clarkston and Newton and extends south to Mendon. Another area is located south of Hyrum Dam, and a third is in the vicinity of the city of Richmond. The association makes up about 8 percent of the survey area.

Mendon soils occupy about 50 percent of the association, and Avon soils occupy about 30 percent. Crookston and Collinston soils, and small areas of Hyrum and Blackrock soils, make up the remaining 20 percent.

All of these soils formed in reworked lake sediment derived from rocks of the Salt Lake Formation. In most places the surface layer is black or dark gray when moist. The Mendon soils are well drained. They have a silt loam surface layer and a clay loam subsoil. Avon soils also are well drained. They have a silty clay loam surface layer and a silty clay subsoil.

The soils of this association are used mainly for nonirrigated crops, but near the towns of Newton, Mendon, and Richmond, much of the acreage is irrigated. The irrigated crops are alfalfa, sugar beets, barley, wheat, corn for silage, and pasture. Where these soils are not cultivated, the vegetation consists mainly of western wheatgrass, bluebunch wheatgrass, balsamroot, and big sagebrush.

6. *Wheelon-Collinston association*

Moderately steep to very steep soils that have a loam, silt loam, and clay loam underlying layer

This association is in two areas. The major one of these is between the towns of Cornish and Clarkston and extends north to the Idaho line. The other area is a narrow band on the extreme west side of the Cache Valley from Clarkston south to the town of Mendon. This association makes up about 4 percent of the survey area.

Wheelon and Collinston soils are about equal in extent and occupy 85 percent of the association. Mendon, Munk and Blackrock soils make up the remaining 15 percent.

The Wheelon soils are well drained, and they are strongly calcareous. The silt loam surface layer is light olive brown when moist. The subsoil is silt loam. The Collinston soils are well drained, and they are strongly calcareous. The silt loam surface layer is dark gray when moist. The subsoil ranges from loam to clay.

The soils of this association are better suited to range than to cultivated crops. They are suitable for reseeding to adapted grasses. Some of the more gently sloping areas are suited to dryfarmed crops. The vegetation consists mainly of bluebunch wheatgrass, prairie junegrass, Great Basin wildrye, balsamroot, aster, buckwheat, geranium, and sagebrush.

7. *Ricks-Timpanogos-Parleys association*

Nearly level and strongly sloping soils that have a gravelly loam, gravelly sandy loam, loam, and clay loam subsoil

This association consists of soils in a narrow band, 2 to 3 miles wide, that extends from the town of Paradise on the south, through the cities of Hyrum, Logan, and Smithfield, and north to the Idaho line. The association occupies about 7 percent of the survey area.

Ricks and Timpanogos soils each occupy about 25 percent of the association, and Parleys and McMurdie soils each occupy about 15 percent. Sterling, Steed, Green Canyon, and Hillfield soils make up the remaining 20 percent.

The Ricks soils are mainly on old river deltas and terraces. They are well drained to somewhat excessively drained. The surface layer is gravelly loam, and the subsoil is sandy loam and gravelly loam. The substratum is very gravelly sand. The Timpanogos soils are well drained. The surface layer is silt loam, and the subsoil is loam. The Parleys soils are well drained and have a silt loam surface layer and a dominantly clay loam subsoil.

The soils of this association are used mostly for cultivated crops. Most areas are irrigated and are used for alfalfa, small grain, corn, peas, beans, orchards, and improved pasture. Nonirrigated areas are used for alfalfa and small grain. Where these soils are not cultivated, the vegetation is mainly bluebunch wheatgrass, balsamroot, buckwheat, and sagebrush.

Well-drained Soils of the Uplands

This group consists of two soil associations. The soils in these associations are similiar in drainage and general location, but they have some contrasting soil characteristics and vary somewhat in position and climate.

The Nebeker-Hendrick association consists of well-drained soils that have a silty clay loam and clay subsoil. The soils are mainly strongly sloping to moderately steep and are on broad alluvial fans above the upper lake terraces. Elevation ranges from 4,800 to 5,700 feet. These soils formed in alluvium and colluvium derived chiefly from sandstone and quartzite rocks. The average annual precipitation is 16 to 20 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 110 to 140 days.

The Richmond-Sterling-Picayune association consists of somewhat excessively drained very gravelly and stony loams and sandy loams. These soils are on very steep terrace escarpments, deltas, and foot slopes of mountains. Elevation ranges from 5,200 to 7,500 feet. The average annual precipitation is 15 to 20 inches, the average annual air temperature is 42° to 48° F., and the frost-free season is 90 to 120 days.

The associations in this group make up about 11 percent of the survey area.

8. Nebeker-Hendricks association

Strongly sloping to moderately steep soils that have a silty clay loam or clay subsoil

This association consists of soils in six areas: (1) northwest of the town of Clarkston, (2) west and south from the town of Mendon, (3) the Dry Lake area, (4) east of the towns of Paradise and Avon, (5) east of the town of Hyde Park, and (6) east and south from the city of Richmond. The association occupies about 6 percent of the survey area.

Nebeker and Hendricks soils are about equal in extent and together make up about 70 percent of this association, and Crowshaw, Hiibner, Hyrum, and Obray soils occupy the remaining 30 percent.

The Nebeker and Hendricks soils are well drained and have a surface layer of silt loam. The subsoil of the Nebeker soils is clay, and that of the Hendricks soils is silty clay loam.

The soils of this association are used mainly for nonirrigated crops of alfalfa and wheat, but some areas are used for range. The vegetation is mainly western wheatgrass, slender wheatgrass, prairie junegrass, balsamroot, yarrow, and big sagebrush.

9. Richmond-Sterling-Picayune association

Somewhat excessively drained soils that have gravelly loam or gravelly sandy loam underlying layers or a gravelly clay loam subsoil.

This association is in four areas: (1) the west slopes of Clarkston Mountains, (2) the west slope of the Wellsville Mountains, (3) the west-facing slopes of the mountains east of the cities of Richmond and Smithfield, and (4) the west-facing mountain slopes east of the towns of Paradise and Avon. The association occupies about 5 percent of the survey area.

Richmond soils occupy about 40 percent of this association, Sterling soils 25 percent, and Picayune soils about 15 percent. Outcrops of limestone rock and small areas of Nebeker soils make up the remaining 20 percent.

The Richmond soils are very steep and are on south- and west-facing mountains. They are somewhat excessively drained, and they are strongly calcareous to very strongly calcareous throughout the profile. The subsoil is very gravely, cobbly, and stony loam. The Sterling soils are very steep and are on south- and west-facing mountains. They are somewhat excessively drained and are strongly calcareous to very strongly calcareous throughout the profile. The Picayune soils generally are in the north-facing areas of the association, but they also are in small pockets in other exposures. They are well drained. The surface layer is very dark grayish brown, noncalcareous gravelly loam. The subsoil is gravelly and cobbly clay loam.

The soils of this association are used for range, wildlife habitat, and watershed. The vegetation is chiefly big sagebrush, juniper, cheatgrass, bluebunch wheatgrass, western wheatgrass, Sandberg bluegrass, yarrow, balsamroot, and bitterbrush. Deer and other wildlife use the vegetation for grazing in winter and spring.

Well-drained and Somewhat Excessively Drained Soils of the Mountains

Soils of this group are dominantly well drained to somewhat excessively drained. The subsoil is very gravelly. These soils formed in residuum, colluvium, and alluvium derived mainly from sandstone or quartzite and some limestone and shale rocks. They are sloping to very steep and are on mountains and alluvial fans at ranges of 5,300 to 8,000 feet. The average annual precipitation is 20 to 30 inches, the mean annual air temperature is 38° to 47° F., and the frost-free season is 50 to 100 days.

Two of the associations in the Cache Area are in this group. They make up about 16 percent of the survey area.

10. Yeates Hollow-Ant Flat-Goring association

Sloping to very steep soils that have a silty clay, clay, and very cobbly clay subsoil

This association consists of sloping to very steep soils on mountains. These soils are in five areas. The major ones of these are the upper Little Bear River area and the Hardware Ranch-Ant Flat area. The smaller ones are the Strawberry Valley area, the Franklin Basin area, and an area east of the town of Cove near the Idaho line. The association makes up about 12 percent of the survey area.

Yeates Hollow soils occupy about 35 percent of the association, Ant Flat soils about 20 percent, and Goring soils 15 percent. LaPlatta and Obray soils occupy the remaining 30 percent.

All the major soils of this association are well drained. The Yeates Hollow soils have a surface layer of extremely stony loam and a subsoil of very cobbly and stony clay. In the Ant Flat soils, the surface layer is loam and the subsoil is clay. The Goring soils have a silt loam surface layer and a silty clay subsoil.

The soils of this association are used for range that is grazed by sheep and cattle and for watershed and wildlife habitat. The vegetation is mainly bluebunch wheatgrass, tall native bluegrass, Great Basin wildrye, prairie junegrass, Columbia needlegrass, yarrow, geranium, balsamroot, lupine, buckwheat, yellowbrush, bitterbrush, and big sagebrush.

11. Sheep Creek-Hoskin-Curtis Creek association

Steep and very steep soils that have a gravelly and cobbly loam to clay loam subsoil

This soil association is in three, long, narrow areas. The largest of these is in the mountain area east of Ant Flat. A second area is on the east slope of Clarkston Mountain, and a third is west and south of the town of Wellesville. Small areas of the association are included in other associations in the mountains and high mountains. The soils generally are on south- or west-facing mountains. The association occupies about 4 percent of the survey area.

Sheep Creek soils occupy about 35 percent of this association, Hoskin soils about 20 percent, and Curtis Creek soils about 15 percent. Agassiz, St. Marys, Bradshaw, and Smarts soils and rock outcrop make up the remaining 30 percent.

Sheep Creek soils are well drained. The surface layer is cobbly loam, and the subsoil is very cobbly clay loam. Hoskin soils are well drained to somewhat excessively drained. The surface layer is cobbly loam or gravelly loam, and the subsoil is very cobbly loam. Curtis Creek soils are well drained. The surface layer is loam or cobbly loam, and the subsoil is loam and sandy clay loam.

The soils of this association are used as range for grazing by sheep and cattle and for watershed and wildlife habitat. The vegetation is mainly bluebunch wheatgrass, tall native bluegrass, Sandberg bluegrass, Great Basin wildrye, yarrow, balsamroot, big sagebrush, bitterbrush, and yellowbrush. Big sagebrush, bluebunch wheatgrass, cheatgrass, and weeds now make up a large part of the plant cover in many areas.

Well-drained and Somewhat Excessively Drained Soils of the High Mountains

Soils of this group are dominantly well drained and somewhat excessively drained. They have a gravelly, cobbly, and stony clay loam subsoil. The Agassiz, Dateman, Bickmore, and Bradshaw soils in this group formed mainly in residuum from limestone. The Lucky Star and Cluff soils formed largely in residuum from sandstone and quartzite rocks. These moderately steep to very steep soils are on mountains at elevations of 5,500 to 9,000 feet. The average annual precipitation is 20 to 35 inches, and the mean annual air temperature is 36 to 45° F.

Three of the associations in the Cache Area are in this group. They make up about 30 percent of the survey area.

12. Agassiz association

Very steep, stony and rocky soils that are silt loam and stony silty clay loam throughout

This association is in five general areas. The two larger of these are in the southeastern part of the county. They are the James Peak and Sharp Mountain area and the East Fork area of the Little Bear River drainage. The smaller areas are north of Monte Cristo Peak, in the Blacksmith Fork Canyon west of Hardware Ranch, and in the Franklin Basin-Beaver Mountain area. The association occupies about 5 percent of the survey area.

Agassiz soils occupy about 70 percent of the association, rock outcrop about 10 percent, and Foxol soils about 6 percent. The Foxol soils are important, particularly in the James Peak area. Bradshaw and Elwood soils make up the remaining 14 percent.

The Agassiz soils are somewhat excessively drained and are very cobbly silt loam and silty clay loam throughout. The Agassiz soils dominantly face to the south or west and are intermingled with outcrops of limestone on ridges and escarpments.

The soils are used mainly for range that is grazed by sheep. Other uses are wildlife habitat and watershed. The vegetation is mainly big sagebrush, curlleaf mountain-mahogany, bluebunch wheatgrass, buckwheat, snowberry, chokecherry, and some juniper.

13. Dateman-Agassiz-Bradshaw association

Steep and very steep soils that are cobbly or very cobbly silt loam and silty clay loam throughout or have a cobbly loam subsoil

This association is in the high mountains extending from the Blacksmith Fork River south to the vicinity of Sharp Mountain. The association occupies about 6 percent of the survey area.

Dateman and Agassiz soils each occupy about 35 percent of the association, and Bradshaw soils about 15 percent. Bickmore soils make up about 9 percent and rock outcrop about 6 percent of the remaining 15 percent.

The Dateman soils are well drained. They have a surface layer of very dark brown cobbly silt loam, and the subsoil is very cobbly silty clay loam. They have north-facing slopes, where the vegetation is conifers. The Agassiz soils are somewhat excessively drained. They are very cobbly silt loam and silty clay loam throughout. They are very steep in south- and west-facing areas in which there are outcrops and ledges of limestone. Bradshaw soils are well drained and have a cobbly loam subsoil. They are steep and very steep, and they are under a plant cover of grass and brush.

The soils of this association are used for range that is grazed mainly by sheep. Wildlife habitat and watershed are also important uses for these soils. The vegetation consists mainly of Douglas-fir and alpine fir on Dateman soils that have north-facing slopes, and bluebunch wheatgrass, Great Basin wildrye, ceanothus, serviceberry, big sagebrush, chokecherry, buckwheat, and balsamroot on other slopes. The trees are harvested for lumber in some areas of the Dateman soils.

14. Lucky Star-Cluff-Bickmore association

Moderately steep and steep soils that have a very cobbly sandy clay loam, gravelly clay, or cobbly silty clay loam subsoil

This association is in eight large areas: (1) the east-facing slopes of Clarkston Mountains, (2) the east-facing slopes of the Wellsville Mountains, (3) the mountain slopes west of the Upper Little Bear River, (4) the upper areas of Hyrum and Paradise Dry Canyons, (5) the areas south of Sharp Mountain to the Weber County Line, (6) the Monte Cristo area joining the Box Elder County Line, (7) the Upper Curtis Creek-Rock Creek area, and (8) the Franklin Basin-Beaver Mountain area. This is the largest association in the survey area and makes up about 19 percent of the total acreage.

Lucky Star soils occupy about 35 percent of the association, Cluff soils 25 percent, and Bickmore soils about 15 percent. Elwood, Fitzgerald, Scout, Elzinga, Maughan, and Scave soils make up the remaining 25 percent.

The Lucky Star soils are deep and well drained and have a very cobbly sandy clay loam subsoil. They have north- and east-facing slopes, where the vegetation is aspen. The Cluff soils are well drained and have a gravelly clay subsoil. The vegetation on these soils is conifers. The Bickmore soils are well drained and have a cobbly silty clay loam subsoil. They are very steep and have north- and east-facing slopes. The vegetation on Bickmore soils also is conifers.

Soils in this association are used mainly for watershed, wildlife habitat, and range. In some areas Douglas-fir is used for timber and the understory is grazed by sheep. In the aspen stands, Douglas-fir and alpine fir grow as scattered trees or are in small clumps. At present, markets for aspen products are limited in the survey area and the aspen sites are grazed by sheep and cattle.

Descriptions of the Soils

This section describes the soil series and mapping units in the Cache Area. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains a brief description of a representative profile that is in terms familiar to the layman. A detailed description of the same profile is given as part of the description of the first mapping unit. This second profile description is in technical terms and is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Mixed alluvial land, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, woodland group, and wildlife group in which the mapping unit has been placed. The page for the description of each of these groups can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*8*).

A given soil series in the Cache Area may be identified by a different name in a recently published soil survey of an adjacent survey area. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil series described in this Area are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained.

Agassiz Series

The Agassiz series consists of somewhat excessively drained, strongly sloping to very steep soils that formed in residuum derived from limestone. These soils occur mostly in mountainous areas at elevations of 5,500 to 8,500 feet. Their slopes face south and west and range from 6 to 70 percent. The annual precipitation is 20 to 35 inches, the mean annual air temperature is 36° to 42° F., and the frost-free season is 80 to 100 days. The vegetation is mainly big sagebrush, curlleaf mountain-mahogany, bluebunch wheatgrass, snowberry, serviceberry, chockecherry, and some juniper trees.

Agassiz soils are commonly associated with Goring, Mult, Elwood, Bradshaw, Dateman, Bickmore, and Lucky Star soils.

In a representative profile, the surface layer is about 18 inches thick and is brown very cobbly silt loam in the upper part and brown very cobbly silty clay loam in the lower part. It is neutral in reaction. Just below the surface layer is limestone bedrock. The upper 4 to 6 inches of the bedrock is fractured, and soil material has filled the cracks.

Agassiz soils are used for watershed, range, and wildlife habitat.

Agassiz rocky silt loam, 6 to 30 percent slopes (AAE).—This sloping to moderately steep soil is in mountainous areas and on ridges above lake terraces throughout the survey area. Rock outcrop covers 2 to 10 percent of the surface.

TABLE 1.—*Approximate acreage and proportionate extent of each mapping unit*

Mapping unit	Area	Extent
	Acres	*Percent*
Agassiz rocky silt loam, 6 to 30 percent slopes	2, 855	0. 5
Agassiz rocky silt loam, 30 to 70 percent slopes, eroded	2, 040	. 4
Agassiz-Bradshaw association, eroded	9, 920	1. 9
Agassiz-Dateman association, eroded	15, 555	2. 9
Agassiz-Elwood association, eroded	2, 640	. 5
Agassiz-Goring association	1, 590	. 3
Agassiz-Goring association, eroded	1, 580	. 3
Airport silt loam, 0 to 3 percent slopes	1, 915	. 4
Airport silty clay loam	1, 540	. 3
Airport-Salt Lake complex	2, 175	. 4
Ant Flat loam, 6 to 20 percent slopes	7, 360	1. 4
Ant Flat-Despain association, eroded	5, 925	1. 1
Avon silty clay loam, 0 to 3 percent slopes	3, 440	. 6
Avon silty clay loam, 3 to 6 percent slopes	2, 000	. 4
Avon silty clay loam, 6 to 10 percent slopes	1, 035	. 2
Avon silty clay loam, 10 to 20 percent slopes	625	. 1
Avon-Collinston complex, 6 to 10 percent slopes	1, 175	. 2
Avon-Collinston complex, 10 to 30 percent slopes	1, 160	. 2
Barfuss-Leatham association	7, 910	1. 5
Battle Creek silty clay loam, 0 to 2 percent slopes	1, 650	. 3
Battle Creek silty clay loam, 8 to 15 percent slopes	565	. 1
Bickmore gravelly silt loam, 30 to 70 percent slopes	330	(1)
Bickmore-Agassiz association, eroded	1, 355	. 3
Bickmore-Sheep Creek association, eroded	8, 515	1. 6
Blackrock extremely stony loam, 10 to 20 percent slopes	440	(1)
Blackrock gravelly loam, 3 to 6 percent slopes	235	(1)
Blackrock gravelly loam, 6 to 10 percent slopes	420	(1)
Blackrock gravelly loam, 10 to 20 percent slopes	495	(1)
Bradshaw-Agassiz association, eroded	5, 185	1. 0
Cache silty clay	1, 560	. 3
Cardon silty clay	2, 222	. 4
Center Creek silt loam	356	(1)
Clegg silt loam, 20 to 30 percent slopes	730	2.
Cluff silt loam, 6 to 30 percent slopes	1, 190	. 2
Cluff-Lucky Star association	2, 120	. 4
Cluff-Scout association	4, 035	. 8
Collett silty clay loam	5, 890	1. 1
Collinston loam, 1 to 6 percent slopes	815	. 2
Collinston loam, 6 to 10 percent slopes	870	. 2
Collinston loam, 10 to 30 percent slopes, eroded	1, 335	. 3
Collinston loamy fine sand, 0 to 3 percent slopes	433	(1)
Crookston loam, 0 to 3 percent slopes	3, 355	. 6
Crookston loam, 3 to 6 percent slopes	395	(1)
Crookston loam, 6 to 10 percent slopes	298	(1)
Crowshaw gravelly loam, 3 to 6 percent slopes	285	(1)
Crowshaw gravelly loam, 6 to 10 percent slopes	1, 065	. 2
Crowshaw gravelly loam, 10 to 20 percent slopes	700	. 1
Curtis Creek-Goring association, hilly	2, 300	. 5
Curtis Creek-Goring association, steep	1, 710	. 3
Dagor silt loam, 4 to 8 percent slopes	305	(1)
Dagor silt loam, 10 to 20 percent slopes	455	(1)
Dateman-Bradshaw association	3, 060	. 6
Dateman extremely rocky silt loam, 40 to 80 percent slopes	7, 545	1. 5
Datwyler cobbly silty clay loam, 30 to 60 percent slopes	655	. 1
Datwyler-Elzinga-Maughan association	6, 450	1. 3
Despain-Bickmore association	1, 780	. 3
Despain-Lucky Star association	840	. 2
Elwood silt loam, 30 to 60 percent slopes	700	. 1
Elwood-Agassiz association	1, 115	. 2
Elwood-Mult association, hilly	1, 350	. 3
Elwood-Mult association, steep	4, 500	. 9
Fitzgerald extremely stony loam, 10 to 20 percent slopes	3, 040	. 6
Flygare silt loam, 3 to 20 percent slopes	1, 625	0. 3
Foxol rocky loam, 30 to 60 percent slopes	5, 050	1. 0
Goring silt loam, 6 to 30 percent slopes	5, 495	1. 1
Goring-Obray association, eroded	8, 440	1. 6
Gravel pit	348	(1)
Green Canyon gravelly loam, 0 to 3 percent slopes	1, 735	. 3
Green Canyon gravelly loam, 3 to 7 percent slopes	440	(1)
Greenson loam, 0 to 3 percent slopes	13, 070	2. 5
Greenson loam, 3 to 6 percent slopes	695	. 1
Greenson loam, 6 to 10 percent slopes	235	(1)
Greenson loam, deep over clay, 0 to 1 percent slopes	413	(1)
Greenson loam, deep over gravel, 0 to 1 percent slopes	244	(1)
Hendricks silt loam, 1 to 3 percent slopes	546	. 1
Hendricks silt loam, 3 to 6 percent slopes	725	. 1
Hendricks silt loam, 6 to 10 percent slopes	1, 560	. 3
Hendricks silt loam, 10 to 20 percent slopes	2, 335	. 5
Hiibner extremely stony clay loam, 1 to 30 percent slopes	1, 480	. 3
Hiibner gravelly clay loam, 3 to 10 percent slopes	212	(1)
Hiibner gravelly clay loam, 10 to 20 percent slopes	305	(1)
Hiibner gravelly clay loam, 20 to 30 percent slopes	205	(1)
Hillfield silt loam, 20 to 30 percent slopes, eroded	285	(1)
Hillfield-Timpanogos silt loams, 10 to 30 percent slopes, eroded	1, 275	. 3
Hoskin cobbly loam, 30 to 70 percent slopes, eroded	1, 810	. 4
Hoskin-Datwyler association, eroded	625	. 1
Hoskin-Elzinga association, eroded	1, 495	. 3
Hoskin-Scave association	3, 115	. 6
Hoskin-Scout association, eroded	4, 210	. 8
Hoskin-Smarts association, eroded	910	. 2
Hoskin gravelly loam, thick surface, 1 to 6 percent slopes	790	. 1
Hyrum gravelly loam, 4 to 8 percent slopes	465	(1)
Hyrum gravelly loam, 10 to 25 percent slopes	620	. 1
Hyrum cobbly loam, 4 to 8 percent slopes	430	(1)
Jordan silty clay loam	975	. 2
Jordan-Lasil silty clay loams	1, 303	. 3
Kidman fine sandy loam, 0 to 2 percent slopes	3, 200	. 6
Kidman fine sandy loam, 8 to 15 percent slopes	225	(1)
Kidman fine sandy loam, deep water table, 0 to 2 percent slopes	8, 310	1. 6
Kidman fine sandy loam, deep water table, 2 to 4 percent slopes	290	(1)
Kidman fine sandy loam, deep water table, 4 to 8 percent slopes	545	. 1
Kirkham-Shay complex	1, 180	. 2
Kirkham-Shay complex, strongly alkali	820	. 2
Lakewin gravelly coarse sandy loam	472	(1)
LaPlatta silty clay loam, 30 to 50 percent slopes	292	(1)
LaPlatta-Obray association	4, 457	. 9
Layton loamy fine sand	1, 920	. 4
Leatham-Barfuss association, eroded	4, 060	. 8
Lewiston fine sandy loam	8, 790	1. 7
Lewiston fine sandy loam, strongly alkali	480	(1)
Logan silty clay loam	2, 035	. 4
Lucky Star silt loam, 6 to 30 percent slopes	5, 900	1. 1
Lucky Star gravelly silt loam, 30 to 60 percent slopes	14, 930	2. 9
Lucky Star-Goring association	4, 460	. 9
Lucky Star-Hoskin association	2, 065	. 4
Lucky Star-Red Spur complex, 6 to 30 percent slopes	1, 185	. 2

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of each mapping unit*—Continued

Mapping unit	Area	Extent
	Acres	*Percent*
Lucky Star-Scout association	2, 595	0. 5
Maughan-Datwyler association	800	. 1
McMurdie silt loam, 0 to 3 percent slopes	725	. 1
McMurdie silt loam, 3 to 6 percent slopes	1, 715	. 4
McMurdie silt loam, 6 to 10 percent slopes	1, 075	. 2
McMurdie-Hillfield silt loams, 10 to 30 percent slopes, eroded	460	(1)
Mendon silt loam, 0 to 3 percent slopes	9, 810	2. 0
Mendon silt loam, 3 to 6 percent slopes	5, 220	1. 0
Mendon silt loam, 6 to 10 percent slopes	2, 030	. 4
Mendon-Collinston complex, 1 to 6 percent slopes	1, 405	. 3
Mendon-Collinston complex, 6 to 30 percent slopes, eroded	4, 970	1. 0
Millville silt loam, 0 to 2 percent slopes	1, 750	. 3
Millville silt loam, 2 to 4 percent slopes	860	. 2
Mixed alluvial land	5, 465	1. 1
Mult-Agassiz association	3, 700	. 7
Mult-Agassiz association, eroded	1, 050	. 2
Mult-Lucky Star association	640	. 1
Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded	2, 830	. 5
Nebeker silt loam, 3 to 6 percent slopes	405	(1)
Nebeker silt loam, 6 to 10 percent slopes	840	. 2
Nebeker silt loam, 10 to 25 percent slopes	4, 600	. 9
Nibley silty clay loam, 0 to 3 percent slopes	7, 160	1. 4
Nibley silty clay loam, 3 to 6 percent slopes	965	. 2
Obray silty clay, 1 to 6 percent slopes	210	(1)
Parleys silt loam, 0 to 3 percent slopes	1, 600	. 3
Parleys silt loam, 3 to 6 percent slopes	890	. 2
Parleys silt loam, 6 to 10 percent slopes	515	(1)
Parlo silt loam, 0 to 3 percent slopes	2, 460	. 5
Parlo silt loam, 3 to 6 percent slopes	385	(1)
Parlo silt loam, 6 to 10 percent slopes	165	(1)
Payson silt loam	1, 190	. 2
Picayune-Agassiz association, eroded	3, 030	. 6
Picayune-Smarts association	905	. 2
Poleline-Agassiz association, eroded	1, 790	. 4
Preston fine sand, 0 to 10 percent slopes	325	(1)
Provo gravelly loam	750	. 1
Provo loam	1, 695	. 3
Quinney silt loam	2, 345	. 5
Richmond very stony loam, 30 to 70 percent slopes, eroded	2, 790	. 5
Richmond-Middle association, eroded	5, 550	1. 1
Richmond-Munk association, eroded	815	. 2
Richmond-Nebeker association, eroded	3, 970	. 8
Richmond-Sterling association, eroded	2, 415	. 5
Ricks gravelly loam, 0 to 3 percent slopes	5, 025	1. 0
Ricks gravelly loam, 3 to 6 percent slopes	1, 545	. 3
Ricks gravelly loam, 6 to 10 percent slopes	965	. 2
Riverwash	260	(1)
Rock land	15, 215	2. 9
Roshe Springs silt loam	2, 735	. 5
Rough broken land	3, 160	. 6
St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes	645	. 1
St. Marys-Curtis Creek association	2, 170	0. 4
Salt Lake silty clay	2, 185	. 4
Salt Lake silty clay loam	790	. 2
Salt Lake-Logan complex	345	(1)
Salt Lake-Roshe Springs complex	3, 085	. 6
Salt Lake-Trenton complex	520	. 1
Scave extremely rocky silt loam, 10 to 30 percent slopes	720	. 1
Scave silt loam, 10 to 30 percent slopes	2, 005	. 4
Scout gravelly loam, 40 to 70 percent slopes	1, 025	. 2
Shay silty clay loam	355	(1)
Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded	3, 820	. 7
Sheep Creek-Agassiz association, eroded	5, 270	1. 0
Sheep Creek-Despain association, eroded	2, 225	. 4
Sheep Creek-Maughan association, eroded	3, 115	. 6
Smarts silt loam, 10 to 30 percent slopes	1, 150	. 2
Smarts-Hoskin association, eroded	3, 950	. 8
Smarts-Lucky Star-Poleline association	6, 000	1. 2
Steed gravelly loam, 0 to 3 percent slopes	2, 620	. 5
Steed gravelly loam, 3 to 6 percent slopes	706	.
Steed gravelly loam, 6 to 10 percent slopes	890	.
Sterling gravelly loam, 6 to 10 percent slopes	595	. 1
Sterling gravelly loam, 10 to 20 percent slopes	2, 895	. 6
Sterling gravelly loam, 20 to 50 percent slopes, eroded	3, 170	. 6
Stony alluvial land	815	. 2
Timpanogos silt loam, 0 to 3 percent slopes	2, 000	. 4
Timpanogos silt loam, 3 to 6 percent slopes	910	. 2
Timpanogos silt loam, 6 to 10 percent slopes	845	. 2
Timpanogos silt loam, 10 to 20 percent slopes, eroded	360	(1)
Timpanogos silt loam, deep water table, 0 to 3 percent slopes	2, 015	. 4
Trenton silty clay loam, 0 to 2 percent slopes	13, 725	2. 6
Trenton silty clay loam, 2 to 4 percent slopes	260	(1)
Trenton silty clay loam, 4 to 8 percent slopes	430	(1)
Trenton silty clay loam, 8 to 20 percent slopes, eroded	745	. 1
Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes	3, 795	. 7
Wheelon silt loam, 10 to 30 percent slopes	1, 605	. 3
Wheelon silt loam, 30 to 50 percent slopes, eroded	3, 720	. 7
Wheelon-Collinston complex, 10 to 30 percent slopes, eroded	9, 400	1. 8
Winn silt loam	2, 290	. 4
Winn-Provo complex	1, 250	. 2
Woods Cross silty clay loam	205	(1)
Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded	8, 110	1. 6
Yeates Hollow extremely rocky silt loam, 6 to 30 percent slopes	5, 410	1. 0
Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes	4, 080	. 8
Total	520, 162	100. 0

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[1] Less than 0.1 percent.

Representative profile, located 1,200 feet north and 1,200 feet west of the SE. corner of sec. 19, T. 10 N., R. 3 E. (profile described between rock outcrops):

A11—0 to 7 inches, brown (7.5YR 5/3) very cobbly silt loam, dark brown (10YR 3/3) when moist; moderate, medium, granular structure; soft, very friable, nonsticky and slightly plastic; many fine and medium roots; neutral; clear, wavy boundary.

A12—7 to 18 inches, brown (7.5YR 5/3) very cobbly light silty clay loam, dark brown (7.5YR 3/3) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many, very fine, discontinuous, interstitial inped pores; neutral; abrupt, broken boundary.

R—18 inches, fractured limestone bedrock (about 90 percent rock); soil material in cracks.

The A horizon ranges from brown or dark brown to grayish brown in the upper part; its hue is 10YR or 7.5YR. Its texture ranges from very cobbly silt loam or extremely stony silt loam to cobbly light silty clay loam. In some places the profile contains a C horizon. The lower part of the A horizon and the C horizon range from brown and dark brown to reddish brown; hue is dominantly 10YR and 7.5YR, but it is 5 YR in places. Texture ranges from very cobbly or channery silty clay loam to very cobbly heavy loam. Coarse fragments, mainly cobblestones and gravel-size or channery fragments of limestone, make up 20 to 60 percent, by volume, of the upper part of the A horizon and 50 to 80 percent of the lower part of the A horizon and the C horizon. Stones cover as much as 10 percent of the surface in places. Depth to limestone bedrock is 10 to 20 inches. Reaction is neutral or mildly alkaline, and this soil is noncalcareous or slightly calcareous.

Permeability is moderate, and this soil holds 2 to 3.5 inches of available water above the bedrock. Some roots penetrate the fractured limestone to a depth of 2 feet or more. Runoff is medium to rapid, and the hazard of erosion is slight to moderate.

This soil is used for range, watershed, and wildlife habitat. (Capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Agassiz rocky silt loam, 30 to 70 percent slopes, eroded (AAG2).—This steep or very steep soil is in mountainous areas and on ridges above lake terraces throughout the survey area. Runoff is rapid or very rapid. This soil is moderately eroded, and the hazard of further erosion is high or very high.

This soil is used for range, wildlife habitat, and watershed. (Capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Agassiz-Bradshaw association, eroded (30 to 70 percent slopes) (ABG2).—This mapping unit consists of steep or very steep soils, mainly in the mountainous areas between Davenport Creek and Blacksmith Fork Canyon but also in the vicinity of Franklin Basin. About 75 percent of the acreage is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and 20 percent is Bradshaw silt loam, 30 to 60 percent slopes.

The Agassiz soil is on the sides of mountains. It has slightly convex slopes that face south and west, and it is moderately eroded. The cover of vegetation is mainly big sagebrush, bluebunch wheatgrass, snowberry, and curlleaf mountain-mahogany.

The Bradshaw soil occupies areas between spur ridges, and it is also on the sides of mountains. This soil has slightly concave slopes that face north and east. The vegetation is mainly serviceberry, snowberry, big sagebrush, ceanothus, and bluebunch wheatgrass.

Included in mapping were areas of Elwood silt loam, 30 to 60 percent slopes, that have a cover of conifers. This included soil makes up about 5 percent of the total acreage in the mapping unit.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. Bradshaw soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Neither soil is in a woodland suitability group; wildlife suitability group 3)

Agassiz-Dateman association, eroded (30 to 70 percent slopes) (ADG2).—Soils of this mapping unit are steep or very steep. They generally occur on Sharp Mountain in areas where spur ridges are common, and they also occupy areas that extend northward to Blacksmith Fork Canyon. About 55 percent of the mapping unit is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and 35 percent is Dateman cobbly silt loam, 40 to 70 percent slopes.

The Agassiz soil has slopes that face east and south. It is moderately eroded. The cover of vegetation is mainly sagebrush, scattered oak brush, maple, and perennial grasses.

The Dateman soil has slopes that face north. A representative profile for this soil is described under the Dateman series. The Dateman soil has a cover of Douglas-fir and alpine fir.

Included in mapping were areas of Bradshaw silt loam, 30 to 60 percent lopes, and of Mult silt loam, 30 to 50 percent slopes. Each of these included soils makes up about 5 percent of the total acreage in the mapping unit. They are in small basins or other concave areas. The Mult soil has a cover of aspen.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. Dateman soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Agassiz-Elwood association, eroded (30 to 70 percent slopes) (AEG2).—This mapping unit consists of steep or very steep soils in mountainous areas of the Logan River drainage areas near Franklin Basin. Elevations range from 7,000 to 8,200 feet, and the annual precipitation is 24 to 30 inches. About 55 percent of the mapping unit is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and 35 percent is Elwood silt loam, 30 to 60 percent slopes.

The Agassiz soil is moderately eroded, and it has slopes that face south and west. The vegetation is mainly big sagebrush, perennial grasses, and forbs.

The Elwood soil has slopes that face north and east. Vegetation on this soil is mainly Douglas-fir and lodgepole pine.

Included in mapping were areas of Fitzgerald extremely stony loam, 10 to 20 percent slopes, and of Mult silt loam, 30 to 50 percent slopes. Each of these included soils makes up about 5 percent of the total acreage in the mapping unit. The Fitzgerald soil is mainly toward the southern end of this predominantly limestone area, and it has slopes that face north. The Mult soil is in pockets and on the bottoms of draws and drainageways. It has a cover of aspen.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. Elwood soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Agassiz-Goring association (6 to 30 percent slopes) (AGE).—This mapping unit is north of Hardware Ranch in mountainous areas characterized by a network of ridges and drainageways. The elevation ranges from 6,500 to 7,500 feet, and the annual precipitation is 22 to 26 inches. About 70 percent of the mapping unit is Agassiz rocky silt loam, 6 to 30 percent slopes, and 30 percent is Goring silt loam, 6 to 30 percent slopes.

The Agassiz soil is on mountain ridges and has slopes that face south and west. It contains slightly more rock outcrop than Agassiz rocky silt loam, 6 to 30 percent slopes. The cover of vegetation is mainly mountain-mahogany and other shrubs, grasses, and forbs.

The Goring soil has concave slopes and is in draws and drainageways. It has a cover of grasses and sagebrush on all aspects.

These soils are used for range, watershed, and wildlife habitat. (The Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. The Goring soil is in capability unit VIe–M, nonirrigated; Mountain Loam range site. Neither soil is in a woodland suitability group; wildlife suitability group 3)

Agassiz-Goring association, eroded (30 to 70 percent slopes) (AGG2).—This mapping unit is in mountainous areas characterized by alternate concave-convex slopes, mainly north of Porcupine Reservoir. The annual precipitation is 20 to 25 inches, and the elevation ranges from 5,500 to 6,500 feet. About 55 percent of the mapping unit is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and about 35 percent is Goring silt loam, 30 to 60 percent slopes.

The Agassiz soil has convex, south- and west-facing slopes and is on ridges and side slopes. It is moderately eroded and has common fragments of limestone the size of stones scattered on the surface. The cover of vegetation is mainly big sagebrush, juniper, and perennial grasses and forbs.

The Goring soil has concave, dominantly east- and north-facing slopes and has a cover of big sagebrush, perennial grasses, and scattered maple trees.

Included in mapping unit were areas of Elzinga silt loam, 30 to 60 percent slopes, and Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded. Each of these included soils makes up about 5 percent of the total acreage of the mapping unit. The Elzinga soil is under dense stands of maple on east- and north-facing areas at the upper extremes of the elevation range for the mapping unit. The Steep Creek soil is under scattered shrubs and forbs at the lower elevation for the unit.

Soils of this mapping unit are used for rangeland, wildlife habitat, and watersheds. (The Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. The Goring soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Neither soil is in a woodland suitability group; wildlife suitability group 3)

Airport Series

The Airport series consists of somewhat poorly drained and poorly drained, saline and alkali soils. These soils formed in mixed lake sediment, derived mainly from limestone and quartzite. They are on low lake terraces at elevations of 4,420 to 4,460 feet. Slopes range from 0 to 3 percent. The vegetation is mainly saltgrass, foxtail, alkali sacaton, greasewood, and pickleweed. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Airport soils are associated with Payson, Logan, and Salt Lake soils.

In a representative profile (fig. 2), the surface layer is gray, mildly alkaline silt loam about 4 inches thick. The subsoil, about 12 inches thick, is gray, moderately alkaline silty clay loam in the upper part and light brownish-gray, very strongly alkaline silty clay loam in the lower part. The substratum is light-gray silty clay loam in the upper part and light-gray silt loam in the lower part. It extends to a depth of 60 inches or more and is very strongly alkaline. Lime has accumulated in the lower part of the subsoil and in the substratum.

Airport soils are used mostly for unimproved meadow pasture. Some areas have been drained and reclaimed and are used for irrigated crops. Principal crops are alfalfa, barley, sugar beets, and improved pasture.

Airport silt loam, 0 to 3 percent slopes (AhA).—This soil is on low lake terraces near the Cache Valley bottom. The areas extend from northwest of the city of Logan to the Idaho line.

Representative profile, about 400 feet south and 1,100 feet west of the northeast corner of sec. 6, T. 12 N., R. 1 E.:

A1—0 to 4 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, thin and medium, platy structure that parts to weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

B2t—4 to 11 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; very hard, firm, very sticky and very plastic; common fine roots; many fine pores; thin continuous clay films; moderately calcareous; moderately alkaline; clear, smooth boundary.

B3ca—11 to 16 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, medium, prismatic structure; very hard, firm, sticky and plastic; few fine roots; many fine pores; thin clay films in pores; strongly calcareous; very strongly alkaline; clear, smooth boundary.

C1ca—16 to 25 inches, light-gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) when moist; massive; extremely hard, firm, sticky and plastic; many fine pores; very strongly calcareous; very strongly alkaline; clear, smooth boundary.

C2—25 to 60 inches, light-gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) when moist; massive; hard, firm, sticky and plastic; many fine pores; common, medium, distinct, brownish-yellow (10 YR 6/6) mottles; very strongly calcareous; very strongly alkaline.

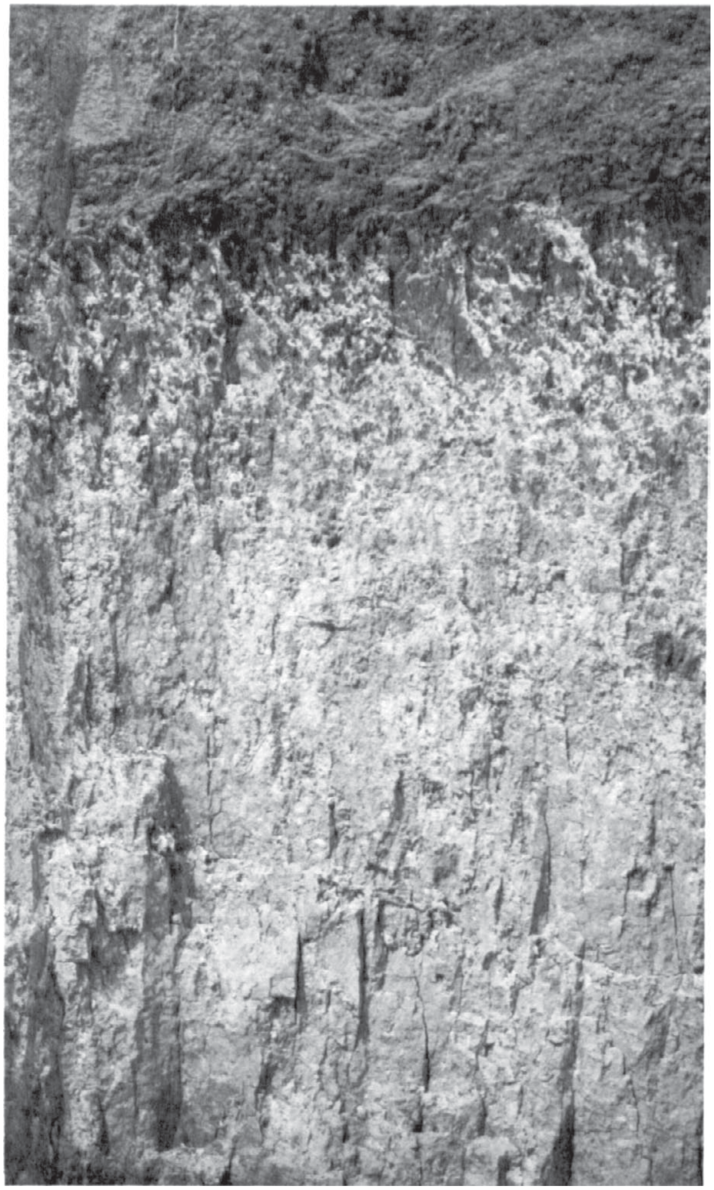

Figure 2.—**Profile of Airport silt loam, 0 to 3 percent slopes. This soil has a light-colored layer of lime accumulation just below the subsoil.**

The A1 horizon ranges from gray to dark gray to dark grayish brown in hues of 10YR and 2.5Y. It ranges from 4 to 11 inches in thickness. The B2t horizon ranges from gray to grayish brown or light brownish gray in hues of 10YR and 2.5Y. Structure most commonly is moderate to strong prismatic. The subsoil and the substratum are very strongly calcareous and are moderately alkaline to very strongly alkaline. Depth to a distinct horizon of carbonate accumulation ranges from 10 to 16 inches. The horizon of carbonate accumulation most commonly occurs in the lower part of the B horizon and extends into the C horizon. The content of exchangeable sodium generally is less than 15 percent in the A1 horizon; it ranges from 16 to 30 percent in the B2t horizon and from 35 to 95 percent in the C horizon. The C horizon ranges from light gray to light grayish brown or pale brown in hues of 10YR, 2.5Y, and 5Y. Its texture ranges mainly from silt loam to silty clay, but there are strata of sandy loam in places. The water table most commonly occurs at a depth of 24 to 36 inches, but it ranges from the surface to a depth of 40 inches. Distinct, brownish-yellow mottles commonly occur between depths of 20 and 40 inches.

This soil is moderately difficult to till. It is somewhat poorly drained. Permeability is slow or very slow in the subsoil and in the substratum. If this soil is drained and reclaimed, it holds 7 to 9 inches of available water to a depth of 5 feet. Plants commonly are shallow rooted because of the high concentrations of salt and alkali in the subsoil and the substratum. Runoff is slow to ponded, and the hazard of erosion is slight.

Included in mapping were small areas of soils that have a silty clay loam surface layer; small areas, generally bare, where the surface layer is strongly affected by alkali; and small areas of a ponded soil. Also included were areas of soils that contain a cemented hardpan.

This soil is used mainly for improved pasture. Drainage and reclamation are needed for cultivated crops. Tile or open drains have been installed in about 40 percent of the acreage. These drained and partly reclaimed areas are used for alfalfa, barley, sugar beets, corn for silage, and improved pasture. Maintaining the level of the water table and the high concentration of salts below the depth reached by crop roots is necessary to sustain good production. (Capability unit IVw–28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Airport silty clay loam (Ak).—This soil occurs at a slightly lower elevation than Airport silt loam, 0 to 3 percent slopes. It has a similar profile, however, except that the surface layer is silty clay loam and the subsoil and the substratum range to heavy silty clay loam. In places the water table is at or near the surface most of the time.

Included in mapping in the vicinity of Logan-Cache Airport were small tracts of a Payson silt loam that occupies areas ½ foot to 2 feet above areas of this Airport soil. Also included were small areas of a soil that has a silt loam surface layer, small areas of a ponded soil, and small areas of a soil that is strongly affected by salt and alkali (slickspots).

About 25 percent of the acreage of this Airport soil is drained and is used for irrigated crops of alfalfa, barley, sugar beets, and corn for silage and for improved pasture. The remaining 75 percent is in native pasture. (Capability unit IVw–28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Airport-Salt Lake complex (Am).—This complex consists of undulating soils on low lake terraces, mainly west and northwest of the city of Logan. About 60 percent of the complex is an Airport silt loam that has a shallow water table, and 40 percent is Salt Lake silty clay. Slopes are generally less than 1 percent.

The Airport soil is in irregularly shaped areas ½ foot to 2 feet above areas of the Salt Lake soil. It has a water table at a depth of 10 to 20 inches most of the time. The Salt Lake soil is in long, narrow, interconnected depressions.

Included in mapping were small areas of soils where slopes are more than 1 percent. Also included were a few small areas of a ponded soil.

Most of the acreage is used as native pasture. A few areas are in improved pasture. (Capability unit IVw–28, irrigated. Airport soil is in Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1. Salt Lake soil is in Wet Meadow range site; not in a woodland suitability group or in a wildlife suitability group)

Ant Flat Series

The Ant Flat series consists of well-drained soils that formed in residuum and colluvium derived from reddish Wasatch sandstone and shale. These soils are gently rolling or strongly sloping to steep and are in mountainous areas. The elevation ranges from 5,600 to 7,500 feet. Slopes range from 6 to 30 percent. The vegetation is dominantly bluebunch wheatgrass, tall native bluegrass, Idaho fescue, bitterbrush, big sagebrush, and snowberry. The average annual precipitation ranges from 20 to 26 inches, and the mean annual air temperature is 38° to 40° F. The frost-free season is 80 to 100 days. The Ant Flat soils are most commonly associated with Goring, Yeates Hollow, Hoskins and Despain soils.

In a representative profile, the surface layer is brown to dark-brown, slightly acid loam about 7 inches thick. The upper part of the subsoil is dark reddish-gray, yellowish-red, and red, neutral clay loam about 25 inches thick. The lower part of the subsoil, to a depth of 60 inches or more, is reddish-yellow, neutral clay loam and is strongly calcareous. Carbonates have been leached from the surface layer and upper part of the subsoil and redeposited in the lower part of the subsoil.

Ant Flat soils are used almost entirely for range, watershed, and wildlife habitat. Some areas were formerly dryfarmed, but most of these are now seeded to grasses.

Ant Flat Loam, 6 to 20 percent slopes (AND).—This moderately sloping to moderately steep soil is on all aspects of mountains. It is mainly in the Ant Flat area south of Hardware Ranch.

Representative profile in a range area, 2½ miles south of Anderson Ranch headquarters, ⅜ mile west of the road, near the north quarter corner of sec. 10, T. 9 N., R. 3 E.:

A1—0 to 7 inches, brown to dark-brown (7.5YR 4/2) heavy loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine and medium roots and a few large roots; slightly acid; clear, wavy boundary.

B1—7 to 11 inches, dark reddish-gray (5YR 4/2) light clay loam, dark reddish brown (5YR 2/3) when moist; moderate, fine, subangular blocky structure; hard, firm, slightly sticky and plastic; many fine and medium roots and a few large roots; many, very fine, discontinuous, random, tubular inped pores; few thin clay films on peds, continuous in pores; thin continuous organic stains; slightly acid; clear, wavy boundary.

B21t—11 to 18 inches, yellowish-red (5YR 5/6) heavy clay loam, yellowish red (5YR 4/6) when moist; strong, medium, subangular blocky structure; extremely hard, very firm, sticky and very plastic; common fine and medium roots and a few large roots; many very fine and few fine, discontinuous, random, tubular inped pores; thin continuous clay films on peds and in pores; thin organic stains; 10 percent gravel; slightly calcareous, lime is nonindurated, laminar, and veined; neutral; clear, wavy boundary.

B22t—18 to 32 inches, red (2.5YR 5/6) clay, dark red (2.5YR 3/6) when moist; weak, coarse, prismatic structure that parts to strong, coarse, subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine and medium roots; few, very fine, and fine, discontinuous, random, tubular inped pores; thin continuous clay films in pores and on peds; cracks up to one-fourth inch wide in some places; moderately calcareous; lime is nonindurated, laminar, and veined; neutral; abrupt, wavy boundary.

B3ca—32 to 60 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; many, fine, discontinuous, interstitial, exped pores; thin clay films on some ped faces and in some pores; strongly calcareous; lime is nonindurated, veined and flaky; neutral.

The thickness of the solum ranges from 24 to 48 inches. The depth to the layer of carbonate accumulation ranges from 18 to 36 inches. The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Texture is dominantly loam but is marginal to silt loam in places. Reaction is slightly acid to neutral. Thickness of the A1 horizon ranges from 7 to 16 inches. The B2t horizon ranges from yellowish red or red to strong brown or reddish brown in a hue of 7.5YR, 5YR or 2.5YR. Texture ranges, from clay to heavy clay loam. Structure is weak to moderate, medium to coarse, prismatic and subangular blocky. Clay films are common to continuous, thin to moderately thick in pores and on some ped faces. Reaction ranges from slightly acid to mildly alkaline. The lower part of the B2t horizon is slightly calcareous to moderately calcareous. The B3ca horizon ranges from brown to red in a hue of 7.5YR, 5YR, or 2.5YR. Texture ranges from clay loam to light clay. Reaction is neutral to moderately alkaline. The B3ca horizon is moderately calcareous to strongly calcareous. In places a strongly calcareous Cca horizon is present. It has about the same colors as the B3ca horizon, but its texture ranges from clay loam to sandy loam.

This soil is fairly easy to till. Permeability is slow in the subsoil and moderately slow in the substratum. From 10 to 12 inches of available water is held to a depth of 5 feet. Plant roots penetrate to a depth of 4 feet or more. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Obray silty clay, 6 to 20 percent slopes, and Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded.

This Ant Flat soil is used almost entirely for range. Some areas were formerly cultivated and used for dryfarming, but these are now mostly seeded to grasses. (Capability unit VIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Ant Flat-Despain association, eroded (6 to 30 percent slopes) (AOE2).—This association lies south of the Hardware Ranch near Ant Flat and extends southward to the Weber County line. About 55 percent of the mapping unit is Ant Flat clay loam, 6 to 30 percent slopes, eroded; 30 percent is Despain gravelly loam, 20 to 30 percent slopes; and about 15 percent is included soils.

The Ant Flat soil is strongly sloping to steep. It has a profile similar to the one described as representative for the series, but the surface layer is clay loam and the subsoil is clay and is at a depth of 5 to 11 inches. This soil is moderately eroded and is strongly calcareous at a depth of 7 to 28 inches. It is underlain by calcareous sandstone at a depth of 40 to 48 inches. The slopes are dominantly 6 to 20 percent, but they range up to 30 percent. Runoff is slow to medium, and the hazard of erosion is moderate. The vegetation is mainly low sagebrush, mulesear dock, Idaho fescue, bluebunch wheatgrass, and yellowbrush.

The Despain soil has a profile similar to the one described as representative for the Despain series, but bedrock is at a depth below 40 inches in some places. Runoff is medium, and the hazard of erosion is moderate. The vegetation is mainly big sagebrush, bluebunch wheatgrass, native bluegrass, serviceberry, and bitterbrush.

Included in mapping were areas of Goring clay loam, 3 to 30 percent slopes; Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded; and an unidentified black clay.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Ant Flat soil is in capability unit VIe–M5, nonirrigated; Mountain Clay range site. Despain soil is in capability unit VIe–M, nonirrigated; Mountain Loam range site. Neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

Avon Series

The Avon series consists of well-drained soils that formed in mixed lake sediment derived chiefly from light-colored tuffaceous sandstone and limestone of the Salt Lake Formation. These soils are on high terraces, mainly along the west side of Cache Valley but partly in a smaller area east of the city of Richmond. The elevation ranges from 4,600 to 5,100 feet. Slopes range from 0 to 20 percent. The vegetation is dominantly bluebunch wheatgrass, western wheatgrass, and big sagebrush. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 110 to 140 days. Avon soils are associated with Collinston, Crookston, Mendon, and Wheelon soils.

In a representative profile, the surface layer and the upper part of the subsoil are dark-gray, neutral silty clay loam. The combined thickness of the surface layer and the upper part of the subsoil is 12 inches. The lower part of the subsoil is dark-gray and dark grayish-brown, mildly alkaline silty clay about 15 inches thick. The substratum, to a depth of 60 inches or more, is light-gray, moderately alkaline silt loam or silty clay loam. Carbonates have been leached from the surface layer and the subsoil and redeposited in the substratum.

Avon soils are used mainly for dryfarmed crops, but some areas are irrigated.

Avon silty clay loam, 0 to 3 percent slopes (ArA).—This soil is on high lake terraces along the west side of Cache Valley.

Representative profile, located northeast of the city of Richmond, 800 feet west of the south quarter corner of sec. 13, T. 14 N., R. 1 E.:

A1—0 to 9 inches, very dark gray (10YR 3/1) light silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, sticky and slightly plastic; many fine and medium roots; common, fine and medium, discontinuous, random, interstitial pores; neutral; clear, wavy boundary.

B1—9 to 12 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; weak, medium prismatic structure that parts to moderate, fine, angular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; few thin clay films in pores; neutral; clear, wavy boundary.

B21t—12 to 18 inches, dark-gray (10YR 4/1) light silty clay, very dark gray (10YR 3/1) when moist; weak, medium, prismatic structure that parts to moderate medium angular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common, fine, discontinuous, random, interstitial pores; common thin clay films in pores and on some peds; noncalcareous; mildly alkaline; clear, smooth boundary.

B22t—18 to 27 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to strong, medium, angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common, fine, discontinuous, random, interstitial pores; many thin clay films on ped faces and in pores; noncalcareous; mildly alkaline; clear, smooth boundary.

Cca—27 to 34 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; very strongly calcareous; lime is nonindurated, massive, veined, and flaky; moderately alkaline; clear, smooth boundary.

C—34 to 60 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; strongly calcareous, lime is nonindurated and massive; moderately alkaline.

The combined thickness of the A1, B1, and B2t horizons ranges from 24 to 41 inches over the lime accumulation. In places the A1 horizon is slightly calcareous because this soil has received overwash of strongly calcareous, eroded material from higher areas. In places small amounts of gravel and cobblestones are scattered on the surface and throughout the profile. Color of the A1 horizon ranges from very dark gray to dark gray. Texture ranges from silty clay loam to silt loam, and reaction is slightly acid to mildly alkaline. Thickness ranges from 9 to 15 inches. The transitional B1 horizon is present in most areas but is lacking in some. The B2t horizon ranges from dark grayish brown or dark gray to light brownish gray or light olive brown in a hue of 10YR or 2.5Y. Texture ranges from silty clay or clay to heavy silty clay loam. Structure ranges from weak to strong, and reaction is slightly acid to mildly alkaline. Thickness ranges from 12 to 26 inches. The C horizon ranges from light gray to white or pale yellow in a hue of 10YR, 2.5Y, or 5Y. Texture ranges from silty clay loam to silt loam, and in places this horizon is 10 to 40 percent unweathered tuffaceous gravel and cobblestones below a depth of 40 inches. The calcium carbonate equivalent in the lime horizon ranges from 15 to 40 percent.

The surface layer is easy to work. Permeability is moderately slow. Runoff is slow, and the hazard of erosion is slight. This soil holds 10 to 12 inches of available water. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of a soil that has a silt loam surface layer, and areas of a soil that has slopes of 3 to 6 percent.

About 85 percent of the acreage of this Avon soil is used for dry farming, and the principal crops are wheat, alfalfa, and safflower. The remaining 15 percent is irrigated and is used for alfalfa and small grain. (Capability unit IIc–2, irrigated, and IIe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Avon silty clay loam, 3 to 6 percent slopes (ArB).—This soil is slightly undulating and is on high lake terraces, mainly along the west side of Cache Valley. It is associated with Avon silty clay loam, 0 to 3 percent slopes. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of a soil that has slopes of 1 to 3 percent and small areas of a soil that has slopes of 6 to 10 percent. Also included were small areas of Collinston loam, 1 to 6 percent slopes.

This Avon soil is used mostly for dryfarmed alfalfa and wheat. Some areas are used for irrigated small grain and alfalfa. (Capability unit IIe–2, irrigated, and IIe–M, nonirrigated; not in a range site or woodland suitability group; wildlife suitability group 3)

Avon silty clay loam, 6 to 10 percent slopes (ArC).—This soil is on high lake terraces and escarpments, mainly along the west side of Cache Valley. It is similar to Avon silty clay loam, 0 to 3 percent slopes, except that it has slopes of 6 to 10 percent and the surface layer is 8 to 12 inches thick. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were a few small areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of Mendon silt loam, 6 to 10 percent slopes. Also included were a few areas of Avon soils that have slopes of 10 to 20 percent or of 3 to 6 percent.

This soil is used for dryfarmed winter wheat and alfalfa. (Capability unit IIIe–2, irrigated, and IIIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Avon silty clay loam, 10 to 20 percent slopes (ArD).—This soil has slopes that mainly face north or east. It is on lake terrace escarpments, mostly along the west side of Cache Valley. This soil is similar to Avon silty clay loam, 0 to 3 percent slopes, except that it is moderately eroded and the surface layer is only 8 to 10 inches thick. Runoff is medium to rapid, and the erosion hazard is moderate to high.

Included in mapping were small areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of Avon silty clay loam, 6 to 10 percent slopes.

This soil is used mostly for dryfarmed alfalfa and small grain. Some small areas are used for range. (Capability unit IVe–2, irrigated, and IVe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Avon-Collinston complex, 6 to 10 percent slopes (AsC).—This complex consists of gently rolling soils on high lake terraces along the west side of Cache Valley. About 70 percent of the complex is Avon silty clay loam, and 30 percent is Collinston loam. Runoff is medium, and the hazard of erosion is moderate.

The Avon soil is similar to Avon silty clay loam, 0 to 3 percent slopes, except that the surface layer is 8 to 10 inches thick. It has more gentle slopes than the Collinston soil, and its slopes face north.

The Collinston soil is similar to Collinston loam, 6 to 10 percent slopes, which is described under the Collinston series. It occupies the more exposed areas on ridges, and it has convex slopes that face south.

Included in mapping were areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of Collinston loam, 10 to 30 percent slopes.

Soils of this mapping unit are used for dryfarmed crops and for interspersed areas of range. Wheat, alfalfa, and safflower are the principal crops. (Capability unit IIIe–2, irrigated, IIIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Avon-Collinston complex, 10 to 30 percent slopes (AsE).—This mapping unit consists of rolling to hilly soils on terrace escarpments along the west side of Cache Valley. About 60 percent of the complex is Avon silty clay loam, 10 to 20 percent slopes, and about 40 percent is Collinston loam, 10 to 30 percent slopes, eroded. The Avon soil is in the less sloping areas and has slopes that face north or east. The Collinston soil is on the more exposed, convex ridges and has slopes that face south or west.

The Avon soil is similar to Avon silty clay loam, 0 to 3 percent slopes, except that it is steeper and its surface layer is 7 to 8 inches thick.

The Collinston soil is similar to Collinston loam, 6 to 10 percent slopes, except that it is steeper and is moderately eroded. In places plowing has exposed the subsoil.

Included in mapping were areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of Collinston loam, 6 to 10 percent slopes.

Soils of this mapping unit are used for dryfarmed wheat and alfalfa and for interspersed areas of range. (Capability unit IVe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Barfuss Series

The Barfuss series consists of well-drained soils. These soils formed in residuum and colluvium derived from light-colored tuff, conglomerate tuffaceous sandstone, and limestone of the Salt Lake Formation. They contain a large amount of volcanic ash. These soils are on slightly concave foothills at elevations of 5,200 to 6,000 feet. Slopes range from 10 to 50 percent. The vegetation is dominantly bluebunch wheatgrass, Great Basin wildrye, native bluegrass, big sagebrush, bitterbrush, and serviceberry. The average annual precipitation ranges from 17 to 20 inches, and the mean annual air temperature is 42° to 45° F. The frost-free season is 80 to 110 days. Barfuss soils are associated with LaPlatta and Leatham soils.

In a representative profile, the surface layer is dark-gray, mildly alkaline silt loam about 10 inches thick. The subsoil is dark-gray and dark grayish-brown, moderately alkaline silty clay loam about 17 inches thick. The substratum, to a depth of 60 inches or more, is white, strongly alkaline silt loam.

Barfuss soils are used mainly for range, watershed, and wildlife habitat.

Barfuss-Leatham association (30 to 50 percent slopes) (BAF).—This mapping unit is mainly south and west of Avon and south of Clarkston, but a small area is on the north end of Wellsville Mountain. About 40 percent of the association is Barfuss silt loam, 30 to 50 percent slopes; 30 percent is Leatham silt loam, 30 to 50 percent slopes; 20 percent is LaPlatta silty clay loam, 30 to 50 percent slopes; and 10 percent is included soils.

The Barfuss soil has slopes that face north and east, and it is in mountainous areas. The vegetation is mainly western wheatgrass, big sagebrush, Sandberg bluegrass, yarrow, bluebunch wheatgrass, bitterbrush, and Great Basin wildrye.

The Leatham soil has slopes that face mainly south and west. It has a cover of cheatgrass, big sagebrush, bluebunch wheatgrass, bitterbrush, snakeweed, and yarrow.

The LaPlatta soil, like the Barfuss, has slopes that face north and east. It has a cover of bluebunch wheatgrass, big sagebrush, Great Basin wildrye, Sandberg bluegrass, and yarrow.

Representative profile of Barfuss silt loam, that has slopes of 30 to 50 percent, in an area of Barfuss-Leatham association, 1,200 feet south and 800 feet west of the northeast corner of sec. 8, T. 9 N., R. 1 E.:

A1—0 to 10 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few medium roots; moderately calcareous; mildly alkaline; clear, smooth boundary.

B21t—10 to 19 inches, dark-gray (10YR 4/1) light silty clay loam, black (10YR 2/1) when moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine, fine, and medium roots; common, very fine and fine, discontinuous, random, vesicular pores; common thin clay films in pores and on some ped faces; moderately calcareous; moderately alkaline; clear, smooth boundary.

B22t—19 to 27 inches, dark grayish-brown (2.5Y 4/2) silty clay loam, very dark grayish brown (2.5Y 3/2) when moist; weak, fine, prismatic structure breaking to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots and few medium roots; common, fine, discontinuous, random, vesicular pores; many thin clay films in pores and on ped surfaces; strongly calcareous, lime is nodular; moderately alkaline; gradual, smooth boundary.

Cca—27 to 60 inches, white (2.5Y 8/1) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; very strongly calcareous; strongly alkaline.

The combined thickness of the A1 and Bt horizons ranges from 20 to 30 inches. The A1 horizon ranges from dark gray to gray. Texture is dominantly silt loam but is light silty clay loam in places. Reaction ranges from neutral to moderately alkaline, and the horizon is slightly to moderately calcareous. In places the profile contains a transitional, very dark gray B1 horizon. The B2t horizon ranges from dark gray to pale brown or light olive brown. Texture is dominantly clay loam or silty clay loam. Reaction is moderately alkaline to strongly alkaline, and the horizon is moderately to strongly calcareous. The Cca horizon ranges from white to pale brown or light gray in a hue of 10YR or 2.5Y. Texture is silt loam or heavy loam. The horizon is strongly or very strongly calcareous.

Permeability is moderately slow, and this soil holds from 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more. Runoff is rapid, and the hazard of erosion is high.

Included in mapping were areas of Wheelon silt loam, 30 to 50 percent slopes, eroded, and of Obray silty clay, 6 to 20 percent slopes. The Wheelon soil is on ridges. It has convex slopes, and the Obray soil has concave slopes. Both soils have slopes that face south and west.

Soils of this mapping unit are used mainly for range, watershed, and wildlife habitat. (Barfuss soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3. Leatham soil is in capability unit VIIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Battle Creek Series

The Battle Creek series consists of well-drained soils. These soils formed in mixed lake sediment derived mainly from limestone, sandstone, and quartzite. They are on lake terraces at elevations of 4,475 to 4,600 feet. Slopes are 0 to 20 percent. The vegetation is dominantly western wheatgrass, bluebunch wheatgrass, and big sagebrush. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 130 to 140 days. Battle Creek soils are mostly commonly associated with Parleys, McMurdie, Collett, Trenton, and Greenson soils.

In a representative profile, the surface layer is grayish-brown, neutral silty clay loam about 6 inches thick. The upper part of the subsoil is grayish-brown to brown, neutral to mildly alkaline silty clay about 13 inches thick. The lower part of the subsoil and the substratum are pinkish-gray, mildly to moderately alkaline silty clay to a depth of 60 inches or more. Carbonates have been leached from the surface layer and upper part of the subsoil and redeposited in the lower part of the subsoil and the substratum.

Battle Creek soils are used for irrigated and dryfarmed crops.

Battle Creek silty clay loam, 0 to 2 percent slopes (BcA).—This soil is on intermediate lake terraces of ancient Lake Bonneville. It is in the northeastern part of Cache Valley.

Representative profile, in a cultivated area 1 mile north and 1½ miles east of the Lewiston sugar factory, 200 feet south and 300 feet west of the northeast corner of sec. 2, T. 14 N., R. 1 E.:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) heavy silty clay loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure mixed with weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine pores; neutral; abrupt, smooth boundary.

B1—6 to 10 inches, grayish-brown (10YR 5/2) silty clay, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular structure; hard, firm, sticky and plastic; few fine roots; few fine pores; neutral; clear, smooth boundary.

B21t—10 to 13 inches, grayish-brown (10YR 5/2) silty clay, dark brown (10YR 3/3) when moist; weak, medium, prismatic structure that parts to weak, fine, subangular blocky structure; very hard, firm, sticky and very plastic; few fine roots; common fine and few medium pores; common thin clay films; slightly calcareous; mildly alkaline; gradual, wavy boundary.

B22t—13 to 19 inches, brown (7.5YR 5/2) silty clay, dark brown (7.5YR 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many fine and few medium pores; common thin clay films; moderately calcareous; mildly alkaline; gradual, wavy boundary.

B3ca—19 to 37 inches, pinkish-gray (7.5YR 6/2) silty clay, dark brown (7.5YR 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky structure; very hard, firm, sticky and very plastic; few fine roots; many fine pores; few thin clay films; strongly calcareous; mildly alkaline; gradual, wavy boundary.

C1ca—37 to 43 inches, pinkish-gray (7.5YR 7/2) silty clay, brown (7.5YR 5/4) when moist; common, medium, faint, strong-brown (7.5YR 5/8) mottles; medium subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine roots; many fine and few medium pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—43 to 72 inches, pinkish-gray (7.5YR 7/2) silty clay, brown (7.5YR 5/4) when moist; few, medium, faint, yellowish-brown (10YR 5/8) mottles; laminated lake sediments; extremely hard, very firm, sticky and very plastic; few fine roots; common fine pores; strongly calcareous; moderately alkaline.

The combined thickness of the A1, B1, and B2t horizons ranges from 12 to 24 inches over the horizon of carbonate accumulation. The A horizon ranges from grayish brown to brown in hues of 10YR or 7.5YR. Texture is dominantly silty clay loam but ranges to light silty clay. Reaction is neutral to mildly alkaline. This horizon generally is noncalcareous but is slightly calcareous in places because of rodent activity. Thickness ranges from 6 to 10 inches. The B2t horizon ranges from 8 to 16 inches in thickness. The carbonate accumulation most commonly is in the lower part of the B horizon and extends into the C horizon. The C horizon ranges from pinkish gray to light brown. Faint mottles commonly are present below a depth of about 30 inches.

This soil is moderately difficult to work, and soil compaction results if the soil is tilled when wet. Permeability is slow. This soil holds from 9 to 10 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more but commonly are concentrated at a depth of 2 or 3 feet. Runoff is slow, and the hazard of erosion is none to slight.

Included in mapping were small areas of Parleys silt loam, 0 to 3 percent slopes.

Most of the acreage is cultivated. About 60 percent of this acreage is dryfarmed, and 40 percent is irrigated. Where irrigation water is available, the principal crops are alfalfa, small grain, corn for silage, sugar beets, and pasture. (Capability unit IIIs–25, irrigated, IIIs–U5, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Battle Creek silty clay loam, 8 to 15 percent slopes (BcD).—This strongly sloping soil is along drainageways on intermediate lake terraces north and east of Richmond. It is similar Battle Creek silty clay loam, 0 to 2 percent slopes, except that it has slopes of 8 to 15 percent, its surface layer is 6 to 8 inches thick, and in places plowing has exposed the subsoil. Runoff is medium, and the erosion hazard is moderate.

Included in mapping were areas of Trenton silty clay loam, 2 to 4 percent slopes, and small areas where slopes are 15 to 20 percent.

This soil is used mostly for dryfarmed alfalfa and small grain. (Capability unit IVe–2, irrigated, IVe–U5, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Bickmore Series

The Bickmore series consists of well-drained soils that have a cobbly silty clay loam subsoil. These soils formed in residuum and colluvium derived from limestone. Bedrock is at a depth between 28 and 40 inches. These soils are 20 to 50 percent cobblestones and gravel-size, angular, limestone rock fragments throughout the profile. They are on mountains at elevations of 6,000 to 8,000 feet, and they have slopes that face north and east and range from 30 to 70 percent. The vegetation is dominantly Douglas-fir and alpine fir and an understory of mountain myrtle, snowberry, chokecherry, ceanothus, and grasses. Average annual precipitation is 25 to 30 inches, mean annual air temperature is 38° to 42° F., and mean soil temperature in summer is less than 59°. The frost-free season is 80 to 100 days. Bickmore soils are most commonly associated with Sheep Creek, Agassiz, Mult, and Picayune soils.

In a representative profile the surface layer is dark-brown to brown, slightly acid gravelly silt loam about 16 inches thick. The upper part of the subsoil is brown or dark-brown, neutral cobbly silty clay loam about 8 inches thick. The lower part of the subsoil is pale-brown, strongly calcareous very cobbly silty clay loam. Carbonates have been leached from the surface layer and redeposited to form a layer of lime above the bedrock.

Bickmore soils are used dominantly for watershed and wildlife habitat, but some areas are grazed or used for woodland.

Bickmore gravelly silt loam, 30 to 70 percent slopes (BGG).—This soil is on mountains and has slopes that face north and east. It is mostly in the South Cottonwood Canyon area or on the Wellsville Mountains, but it is also in the mountain areas south of Avon.

Representative profile, located in South Cottonwood Canyon, 800 feet south of the northwest corner of sec. 30, T. 10 N., R. 3 E.:

O1—4 to 1½ inches, fir needles.

O2—1½ inches to 0, partly decomposed fir needles.

A11—0 to 2 inches, dark-brown (10YR 3/3) gravelly silt loam, very dark grayish brown (10YR 3/3) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; loose, very friable, nonsticky and slightly plastic; many fine and common fine and medium roots; 20 percent gravel; slightly acid; abrupt, wavy boundary.

A12—2 to 16 inches, dark-brown to brown (10YR 4/3) gravelly silt loam, dark brown (10YR 3/3) when moist; moderate, coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and common medium and large roots; 20 percent gravel; neutral; clear, broken boundary.

B2t—16 to 24 inches, dark-brown to brown (10YR 4/3) cobbly silty clay loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine and medium roots; common thin clay films on peds; 40 percent cobblestones; neutral; clear, irregular boundary.

B3ca—24 to 37 inches, pale-brown (10YR 6/3) very cobbly silty clay loam, brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; slightly hard, firm, sticky and plastic; many fine and medium roots; few thin clay films on peds; 50 percent cobblestones; strongly calcareous; neutral; abrupt, discontinuous boundary.

R—37 inches, fractured limestone bedrock, about 90 percent rock with material similar to that of the B3ca horizon in the cracks.

The O horizon ranges from 2 to 4 inches in thickness. The combined thickness of the A1 and B2t horizons ranges from 18 to 36 inches. The A1 horizon has a hue of 10YR or 7.5YR. Texture is dominantly gravelly silt loam but is gravelly loam in places. From 15 to 50 percent of this horizon is gravel and cobblestones. Reaction is slightly acid to neutral. Thickness ranges from 13 to 16 inches. The B2t horizon ranges from brown or dark brown to pale brown in a hue of 10YR or 7.5YR. Texture is dominantly cobbly light silty clay loam or cobbly clay loam and 20 to 50 percent of the horizon is cobblestones and gravel. Reaction is medium acid to neutral. The B3ca horizon has the same colors and texture as the B2t horizon, except that the content of cobblestones and gravel ranges from 50 to 80 percent, by volume. Reaction ranges from neutral to moderately alkaline, and the soil is moderately calcareous to strongly calcareous.

Included in mapping were areas of Agassiz rocky silt loam, 30 to 70 percent slopes, eroded. This included soil makes up about 10 percent of the total acreage.

Permeability is moderate. This soil holds 4 to 6 inches of available water above the bedrock. Some plant roots extend into the cracks in the bedrock. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used entirely for watershed, woodland, range, and wildlife habitat. Some timber formerly was harvested; but now only a few trees are cut. (Capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Bickmore-Agassiz association, eroded (30 to 80 percent slopes) (BKG2).—This mapping unit consists of soils in somewhat dissected scarp areas on the west side of Clarkston Mountain. Elevation ranges from 5,500 to 7,500 feet. Average annual precipitation is 20 to 25 inches. About 40 percent of the association is Bickmore gravelly silt loam, 30 to 70 percent slopes; 30 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and 20 percent is Picayune cobbly loam, 50 to 80 percent slopes. The other 10 percent is rock outcrop and minor soils.

The Bickmore soil is on the north-facing mountains under Douglas-fir and alpine fir. The Agassiz soil is on the sharp ridgetops in association with rock ledges and rock outcrop. The cover is shrubs and grass.

These soils are used entirely for watershed, range, and wildlife habitat. The wooded areas of Bickmore soils are inaccessible and are not used for wood products. (Bickmore soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. The Picayune soil is in capability unit VIIe–M4, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Bickmore-Sheep Creek association, eroded (30 to 70 percent slopes) (BLG2).—This mapping unit is in the Little Bear River drainage area in the vicinity of Three-Mile Canyon and Public Grove Hollow. About 40 percent of it is Bickmore gravelly silt loam, 30 to 60 percent slopes; 30 percent is Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded; 20 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and about 10 percent is included soils.

The Bickmore soil is on north-facing mountain areas under a cover of Douglas-fir and alpine fir. The Sheep Creek soil is on the lower part of south-facing mountain areas under a cover of sagebrush, bluebunch wheatgrass, bitterbrush, cheatgrass, and tall bluegrass. The Agassiz soil is on the upper part of south-facing mountain areas and convex ridges under a cover of curlleaf mountain-mahogany, bluebunch wheatgrass, sagebrush, and Oregon grape.

Included in mapping were areas of a deep, well-drained, fine-textured soil and a deep, well-drained loam.

Soils of this mapping unit are used entirely for range, watershed, and wildlife habitat. The areas of Bickmore soils are nearly inaccessible, and few trees have been cut. (Bickmore soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4. Sheep Creek soil is in capability unit VIIe–M4 nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Blackrock Series

The Blackrock series consists of well-drained soils that have a gravelly loam subsoil. These soils formed in mixed alluvium and colluvium derived from light-colored tuff, tuffaceous sandstone, and limestone. They are on alluvial fans and rolling foothills. These foothill areas are known locally as Newton Hill, Bergeson Hill, and Blackrock and Round Mountains. Elevations range from 4,600 to 5,700 feet, and slopes are 3 to 70 percent. The vegetation is mainly big sagebrush, bitterbrush, bluebunch wheatgrass, Great Basin wildrye, and cheatgrass. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the average frost-free season is 120 to 140 days. Blackrock soils are most commonly associated with Munk, Collinston, Mendon, and Wheelon soils.

In a representative profile, the surface layer is dark-gray, neutral gravelly loam about 22 inches thick. Below this is a layer of grayish-brown, neutral gravelly heavy loam about 17 inches thick. Between depths of 39 and 60 inches is light-gray, mildly alkaline, strongly calcareous gravelly clay loam.

Blackrock soils are used mainly for range, but some areas are used for dryland crops of alfalfa and small grain.

Blackrock gravelly loam, 10 to 20 percent slopes (BmD).—This soil is on foot slopes of Newton Hill, Bergeson Hill, and Blackrock and Round Mountains. It is mainly associated with Munk gravelly loam, 30 to 70 percent slopes.

Representative profile, located 2½ miles southwest of Trenton, 200 feet south and 800 feet east of the northeast corner of the southeast quarter of sec. 9, T. 13 N., R. 1 W.:

A11—0 to 8 inches, dark-gray (10YR 4/1) gravelly loam, black (10YR 2/1) when moist; moderate, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine, medium, and large roots; common medium pores; about 30 percent gravel; neutral; clear, smooth boundary.

A12—8 to 22 inches, dark-gray (10YR 4/1) gravelly heavy loam, black (10YR 2/1) when moist; moderate, medium, granular structure; hard, firm, sticky and plastic; many fine and medium roots; common fine and medium pores; about 25 percent gravel; neutral; clear, smooth boundary.

AC—22 to 39 inches, grayish-brown (10YR 5/2) gravelly heavy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; hard, firm, sticky and plastic; few fine roots; many fine and medium pores; about 40 percent gravel; neutral; clear, wavy boundary.

Cca—39 to 60 inches, light-gray (10YR 7/2) gravelly clay loam, dark grayish brown (10YR 4/2) when moist; massive; hard, firm, sticky and plastic; few fine roots; few fine pores; about 20 percent gravel; strongly calcareous; mildly alkaline.

The A1 horizon ranges from dark gray to very dark gray. Texture is gravelly loam to stony loam. Reaction is neutral to mildly alkaline. Thickness ranges from 20 to 25 inches. The content of gravel in the A1 horizon is 15 to 35 percent. The Cca and C horizons range from light gray to very pale brown in hues of 10YR to 2.5Y. Texture is gravelly loam, gravelly clay loam, or very gravelly loam. The very gravelly loam is at a depth of more than 40 inches. The content of coarse fragments ranges from 10 to 35 percent. Reaction is mildly alkaline to neutral. This horizon is moderately to strongly calcareous. The depth to the horizon of carbonate accumulation ranges from 23 to 46 inches.

This soil is fairly easy to till. Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds about 7.5 to 9 inches of available water to a depth of 5 feet. Plant roots extend to a depth of 5 feet or more.

Included in mapping were small areas of Hyrum gravelly loam, 10 to 25 percent slopes, and small areas of limestone rock outcrop.

This soil is used mostly for dryfarmed crops of small grain and alfalfa. Some areas are used for range. (Capability unit IVe–UX, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Blackrock gravelly loam, 3 to 6 percent slopes (BmB).—This soil is on alluvial fans. It is associated with Blackrock gravelly loam, 10 to 20 percent slopes, and is similar to that soil, except that the surface layer is 20 to 27 inches thick. Runoff is slow, and the hazard of erosion is slight.

Included in mapping were small areas of loamy, nongravelly soils and a few small cobbly and stony areas.

This soil is used mostly for dryfarmed crops of winter wheat and alfalfa. (Capability unit IIe–2, irrigated, IIIe–UX, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Blackrock gravelly loam, 6 to 10 percent slopes (BmC).—This soil is on alluvial fans. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas where slopes are 10 to 20 percent.

About 50 percent of the acreage is used for dryfarmed crops of alfalfa and winter wheat, and the rest is used for range. (Capability unit IIIe–2, irrigated, IIIe–UXE, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Blackrock extremely stony loam, 10 to 20 percent slopes (BnD).—This soil is on the high lake terrace escarpments in the vicinity of the town of Cove. It is similar to Blackrock gravelly loam, 10 to 20 percent slopes, except that from 15 to 25 percent of the surface layer and the subsoil is stones and as much as 70 percent of the lower part of the substratum is cobblestones and other stones. Also, the surface layer is 20 to 23 inches thick. The available water holding capacity is 6 to 7 inches. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of soil that has a clay loam texture, and small wet spots or seep areas. Also included were small areas of limestone rock outcrop.

This soil is used for range. It is too stony for cultivation. (Capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Bradshaw Series

The Bradshaw series consists of well-drained soils. These soils formed in colluvium derived from limestone. They are on north- and east-facing mountain areas or in slightly concave drainageways between ridges. The elevation ranges from 6,000 to 7,500 feet. Slopes range from 30 to 60 percent. The vegetation is dominantly Great Basin wildrye, bluebunch wheatgrass, serviceberry, big sagebrush, chokeberry, and snowberry. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature ranges from 38° to 42° F., and the frost-free season is 80 to 100 days. Bradshaw soils are commonly associated with Mult, Agassiz, Elwood, and Dateman soils.

In a representative profile, the surface layer is dark-brown, neutral silt loam about 14 inches thick. The subsoil is yellowish-brown, neutral cobbly loam about 13 inches thick. The substratum is yellowish-brown, neutral very cobbly loam. Limestone bedrock is at depths below 40 inches in places.

Bradshaw soils are used entirely for range, watershed, and wildlife habitat.

Bradshaw-Agassiz association, eroded (30 to 70 percent slopes) (BSG2).—This mapping unit consists of soils mainly in mountainous areas between Davenport Creek and the lower part of Blacksmith Fork Canyon. About 55 percent of the association is Bradshaw silt loam, 30 to 60 percent slopes; 40 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and 5 percent is included soils.

The Bradshaw soil is steep and very steep and has slightly concave slopes that face north and east. It is between spur ridges in mountainous areas. The vegetation is mainly snowberry, ceanothus, big sagebrush, serviceberry, chokeberry, and bluebunch wheatgrass.

The Agassiz soil is very steep and has slightly convex slopes that face south and west. The vegetation is mainly big sagebrush, serviceberry, curlleaf mountain-mahogany, and bluebunch wheatgrass.

Representative profile of Bradshaw silt loam having slopes of 30 to 60 percent, in an area of the Bradshaw-Agassiz association, eroded, 200 feet north of the south quarter corner of sec. 8, T. 8 N., R. 2 E.:

A1—0 to 14 inches, dark-brown (10YR 3/3) silt loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and large roots; 10 percent gravel; neutral; gradual, irregular boundary.

B2—14 to 27 inches, yellowish-brown (10YR 5/4) cobbly loam, dark yellowish brown (10YR 4/4) when moist; weak, very coarse, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; common fine, medium, and large roots; 40 percent cobblestones and gravel; neutral; clear, wavy boundary.

C—27 to 60 inches, yellowish-brown (10YR 5/4) very cobbly loam, dark yellowish brown (10YR 4/4) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; 50 percent gravel and cobblestones; neutral.

The A1 horizon ranges from dark brown to brown. This horizon is dominantly silt loam but in places is gravelly very fine sandy loam that is 10 to 20 percent gravel, by volume. Reaction is slightly acid to neutral. Thickness ranges from 10 to 19 inches. The B2 horizon ranges from yellowish brown to light brownish gray. It is cobbly loam ranging to gravelly loam that is 30 to 50 percent cobblestones and gravel. Reaction is neutral to moderately alkaline. Thickness ranges from 13 to 22 inches. The C horizon ranges from yellowish brown to brown or pale brown. This horizon ranges from very cobbly loam or very gravelly loam to very gravelly sandy loam that is 40 to 80 percent gravel and cobblestones. Reaction is neutral to moderately alkaline.

Permeability is moderate to moderately rapid. This soil holds 5 to 7 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

Included in mapping were areas of Lucky Star gravelly loam, 30 to 60 percent slopes, and of Bickmore gravelly silt loam, 30 to 70 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Bradshaw soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Cache Series

The Cache series consists of poorly drained, saline soils. These soils formed in fine-textured lake sediment on flat valley bottoms or on lake plains. They are mainly west of Amalga. Elevations are from 4,420 to 4,440 feet. Slopes are 0 to 1 percent. The vegetation is saltgrass and pickleweed. Large areas are bare. The average annual precipitation is 14 to 17 inches, the mean annual air temperature ranges from 45° to 48° F., and the frost-free season is 110 to 160 days. Cache soils are associated with Trenton and Jordan soils.

In a representative profile, the surface layer is light brownish-gray, mildly alkaline silty clay about 4 inches thick. The underlying layer is light-gray and very pale brown to white, mildly alkaline silty clay that extends to a depth of more than 60 inches. These soils are strongly calcareous and strongly affected by salt and alkali.

Cache soils are essentially wasteland, but they have some use for wildlife habitat.

Cache silty clay (Ca).—This soil is on salt-encrusted lake plains, mainly west of Amalga and north of Trenton. Slopes are 0 to 1 percent.

Representative profile, about ½ mile north and 2 miles west of Amalga Church, 800 feet east and 200 feet north of the southwest corner of the quarter of sec. 14, T., 13 N., R. 1 W.:

A1sa—0 to 4 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) when moist; weak, very fine, subangular blocky structure and weak, fine, granular structure; hard, firm, sticky and plastic; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

C1sa—4 to 25 inches, light-gray (10YR 7/2) silty clay, brown (10YR 5/2) when moist; common, medium, distinct, dark-brown (7.5YR 4/4) mottles; massive; extremely hard, very firm, very sticky and very plastic; strongly calcareous; mildly alkaline; distinct, smooth boundary.

C2sa—25 to 39 inches, very pale brown (10YR 7/3) silty clay, brown (10YR 5/3) when moist; common, medium, distinct, dark-brown (7.5YR 4/4) mottles; massive; extremely hard, very firm, very sticky and very plastic; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

C3sa—39 to 72 inches, white (5Y 8/2 and 10YR 8/2) silty clay, light olive gray (5Y 6/2) and light brownish gray (10YR 6/2) when moist; common, medium, distinct, yellowish-red (5YR 4/8) mottles; massive; extremely hard, very firm, very sticky and very plastic; strongly calcareous; mildly alkaline.

The A1 horizon ranges from light grayish brown to pale olive in a hue of 10YR, 2.5Y, or 5Y. Reaction is mildly to strongly alkaline. Thickness ranges from 3 to 5 inches. Texture is silty clay to heavy silty clay loam. The C horizon dominantly is white to light gray or very pale brown and ranges in a hue of 10YR, 2.5Y, or 5Y. Texture is silty clay to clay. Common to many, medium and coarse, distinct mottles ranging in color from 7.5YR 4/4 to 5Y 4/8 are below the surface soil. Reaction is mildly alkaline to strongly alkaline.

A salt crust commonly is on the surface, and the content of salt is more than 2 percent throughout the profile. Permeability is very slow. Runoff is very slow to ponded, saturated with water, but little of the water is available for plant growth because of the high content of salt. The water table generally is at or near the surface, and some areas are ponded for long periods.

Included in mapping were small areas of Airport silty clay loam.

In most places this soil is bare and is not suitable for cropping. It has limited use for wildlife habitat. (Capability unit VIIIw–28, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 1)

Cardon Series

The Cardon series consists of somewhat poorly drained soils that formed in mixed lake sediment derived from limestone and shale. These soils are on low lake terraces in the Youngward area southwest of the city of Logan. The elevation ranges from 4,420 to 4,470 feet. Slopes range from 0 to 3 percent. In uncultivated areas, mound microrelief is evident. The vegetation is foxtail, Kentucky bluegrass, saltgrass, and gumweed. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 46° to 48° F., and the frost-free season is 120 to 130 days. Cardon soils are most commonly associated with Greenson, Salt Lake, Collett, Nibley, and Logan soils.

In a representative profile, the surface layer is dark-gray, mildly alkaline silty clay about 11 inches thick. Below this is 51 inches of light-gray silty clay. The substratum is light-gray, extremely hard, massive silty clay that contains yellowish-brown or brown mottles. In summer, cracks from 1 to 2 inches wide open in the surface layer and in the material below it and remain open for more than 90 days unless the soil is irrigated. Deep cracking, to depths of 40 to 55 inches, and sloughing of soil material from the surface layer into the cracks have caused a mixing of colors below a depth of 10 to 15 inches (fig. 3). The soil generally is saturated within a depth of 30 inches if it is not drained, but it dries out to depths of 40 to 60 inches late in summer.

Cardon soils are used for irrigated crops and unimproved pasture.

Cardon silty clay (Cd).—This soil is on the broad, smooth, low lake terraces. Slopes are 0 to 3 percent.

Representative profile in a cultivated area, 1½ miles north of College Ward Church, 400 feet south and 200 feet east of the northwest corner of the northeast quarter of sec. 18, T. 11 N., R. 1 E.:

Ap—0 to 7 inches, dark-gray (2.5Y 4/1) silty clay, very dark gray (2.5Y 3/1) when moist; moderate, medium, subangular blocky structure that parts to weak, fine, granular structure; extremely hard, firm, sticky and plastic; common medium and large roots; few fine pores; moderately calcareous; mildly alkaline; clear, smooth boundary.

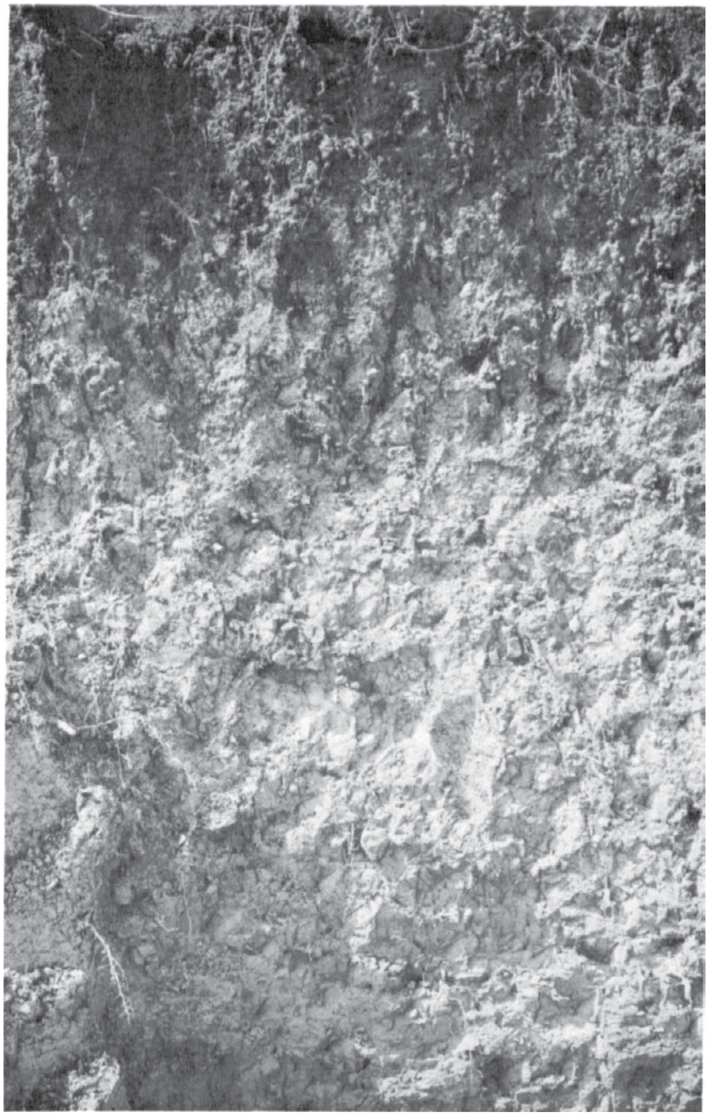

Figure 3.—**Profile of Cardon silty clay. Deep cracks form when this soil is dry. Dark-colored veins can be seen in the light-colored underlying material, where material from the surface layer has washed into the cracks.**

A12—7 to 11 inches, dark-gray (2.5Y 4/1) silty clay, very dark gray (2.5Y 3/1) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; extremely hard, extremely firm, sticky and plastic; many fine roots and few medium roots; common fine pores; moderately calcareous; mildly alkaline; clear, irregular boundary.

AC—11 to 34 inches, light-gray (2.5Y 7/2) and dark-gray (2.5Y 4/1) silty clay, light brownish gray (2.5Y 6/2) and very dark gray (2.5Y 3/1) when moist; irregular shaped peds with long axis not parallel to the surface; common slickensides; extremely hard, extremely firm, sticky and plastic; common fine roots and few medium roots; many fine pores; strongly calcareous; mildly alkaline; clear, irregular boundary.

C1—34 to 62 inches, light-gray (2.5Y 7/2) silty clay, light brownish gray (2.5Y 6/2) when moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; extremely hard, extremely firm, sticky and plastic; few medium roots; common fine pores; strongly calcareous; moderately alkaline.

The A horizon ranges from very dark gray to gray in a hue of 10YR or 2.5Y. Texture ranges from silty clay to heavy silty clay loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous. Its thickness ranges from 7 to 12 inches. The AC horizon is mixed, consisting of about 50 percent material that is A1 horizon and 50 percent C horizon. The upper part is dominated by the A1 horizon, and the lower part by the C horizon. The parallelepiped structure is weak to moderate, and slickensides are common to many. The C horizon ranges from light gray to light grayish brown in a hue of 10YR or 2.5Y. Texture ranges from silty clay to clay or heavy silty clay loam. Reaction ranges from moderately alkaline to strongly alkaline, and the horizon is strongly calcareous. Common, medium, distinct, yellowish-brown mottles occur at depths between 20 and 40 inches.

This soil is sticky and difficult to till. Permeability is very slow. This soil holds from 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate to depths of 5 feet or more. Runoff is slow, and the hazard of erosion is none to slight.

Included in mapping were a few small areas of Salt Lake soils.

This soil is used for irrigated crops and native pasture. The principal crops are alfalfa, small grains, and improved pasture plants. Some sugar beets and corn and silage is grown. (Capability unit IIIw-25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Center Creek Series

The Center Creek series consists of somewhat poorly drained soils that formed in mixed alluvium derived mainly from limestone rocks. These soils are on dry lake bottoms or fans at elevations of 5,600 to 5,700 feet. Slopes range from 1 to 3 percent. The vegetation is mainly water-tolerant grasses and sedges. Average annual air temperature is 42° to 44° F., and the frost-free season 75 to 90 days. Center Creek soils are associated with the soils of the Clegg and Hendricks series.

In a representative profile, the surface layer is dark grayish-brown, medium acid silt loam about 8 inches thick. The subsoil is dark grayish-brown and pale-brown, slightly acid silty clay loam 34 inches thick. The substratum, to a depth of 60 inches or more, is pale-brown, neutral silty clay loam and light yellowish-brown very fine sandy loam.

Center Creek soils are used for dryfarming, hay, and pasture. Alfalfa and small grain are the principal crops.

Center Creek silt loam (CE).—This soil is on valley bottoms in the Dry Lake area. Slopes are 1 to 3 percent.

Representative profile, approximately 800 feet west of the east quarter corner of sec. 32, T. 10 N., R. 1 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; hard, friable, slightly sticky and plastic; common fine roots and few medium and large roots; common, very fine, discontinuous, interstitial pores; medium acid; abrupt, smooth boundary.

B1—8 to 15 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; common fine roots and few medium and large roots; many, very fine, continuous, horizontal, inped tubular pores; few thin clay films in pores; slightly acid; gradual, smooth boundary.

B21t—15 to 26 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; strong, coarse, prismatic structure; very hard, very firm, sticky and plastic; common fine roots and few medium roots; many, very fine, continuous, vertical, inped tubular pores; common, moderately thick clay films in pores; slightly acid; gradual, wavy boundary.

B22t—26 to 34 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; common, coarse, distinct, strong-brown (7.5YR 5/8) mottles; moderate, coarse, prismatic structure; hard, firm, slightly sticky and plastic; many very fine tubular pores and few, fine, continuous tubular pores; common fine roots and few medium roots; few thin clay films in pores; thin organic staining on ped surfaces; slightly acid; gradual, wavy boundary.

B23t—34 to 42 inches, pale-brown (10YR 6/3) light silty clay loam, brown to dark brown (10YR 4/3) when moist; common, fine, distinct, strong-brown (7.5YR 5/8) mottles; weak, coarse, prismatic structure; hard, firm, slightly sticky and plastic; common very fine roots and few fine and medium roots; few thin clay films in pores; thin organic staining on ped surfaces; slightly acid; gradual, wavy boundary.

C1—42 to 52 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) when moist; few, fine, distinct, strong-brown (7.5YR 5/8) mottles; weak, coarse, prismatic structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; many very fine and few fine tubular pores; neutral; clear, smooth boundary.

C2—52 to 60 inches, light yellowish-brown (10YR 6/4) very fine sandy loam, dark yellowish brown (10YR 4/4) when moist; many, coarse, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; neutral.

The A horizon ranges from dark grayish brown to dark gray. Texture ranges from silt loam to light silty clay loam. Reaction is medium acid to neutral. Thickness ranges from 6 to 9 inches. The B1 horizon is only 4 to 8 inches thick and ranges from dark grayish brown to dark gray. The B2t horizon has common, coarse to fine, distinct mottles at depths below 26 inches. Its texture ranges from silty clay loam to fine sandy loam, and stratification is common.

This soil is fairly easy to till. Permeability is moderately slow. Runoff is slow to very slow, and the hazard of erosion is slight. Some areas are inundated until early in summer during years of high runoff. This soil holds 11 to 13 inches of available water to a depth of 5 feet. The depth to the water table ranges from 28 to 40 inches during the growing season. Roots are mostly in the upper 30 inches, above the water table, but extend to a depth of 60 inches or more.

This soil is used mostly for alfalfa, small grain, and native pasture. Water management and controlling the water table are important management needs. (Capability unit IIIw-3, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Clegg Series

The Clegg series consists of well-drained soils that formed in alluvium derived chiefly from limestone. These soils are on alluvial fans at elevations of 5,600 to 6,000 feet. Slopes range from 20 to 30 percent. The vegetation is dominantly maple, chokecherry, and some aspen and an understory grasses and forbs. The average annual precipitation is 22 to 24 inches, the mean annual air temperature is 42° to 43° F., and the frost-free season is 80 to 100 days. Clegg soils are most commonly associated with Bickmore, Agassiz, Datwyler, and Sheep Creek soils.

In a representative profile, the surface layer is dark-brown, slightly acid silt loam about 6 inches thick. The subsoil is brown, slightly acid heavy loam about 14 inches thick. The substratum, to a depth of 60 inches or more, is pale-brown, mildly alkaline, strongly calcareous very cobbly very fine sandy loam. All carbonates have essentially been leached from the surface layer and the upper part of the subsoil. A distinct layer of carbonate accumulation is at a depth of about 25 inches.

Clegg soils are used for range, watershed, and wildlife habitat.

Clegg silt loam, 20 to 30 percent slopes (CFE).—This soil is on alluvial fans in the Dry Lake area.

Representative profile, 1,600 feet south and 200 feet east of the northwest corner of sec. 29, T. 10 N., R. 1 W.:

O1—1½ inches to 0, matted leaves and twigs.

A1—0 to 6 inches, dark-brown (7.5YR 3/2) silt loam, very dark brown (7.5YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots and few large roots; common fine interstitial pores and few medium, interstitial pores; 10 percent gravel; slightly acid; gradual, wavy boundary.

B2t—6 to 20 inches, brown (7.5YR 4/2) heavy loam, dark brown (7.5YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; many fine and medium roots and few large roots; common fine interstitial pores; few thin clay films in pores and on some ped faces; 10 percent gravel; slightly acid; gradual, wavy boundary.

IIC1—20 to 25 inches, pale-brown (10YR 6/3) very cobbly very fine sandy loam, olive brown (2.5Y 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; common fine pores; 60 to 70 percent cobblestones and gravel; neutral; clear, smooth boundary.

IIC2ca—25 to 60 inches, pale-brown (10YR 6/3) very cobbly very fine sandy loam, olive brown (2.5Y 4/3) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; 60 to 80 percent cobblestones and gravel; strongly calcareous; mildly alkaline.

The O1 horizon ranges from 1 to 2 inches in thickness. The A1 horizon ranges from dark brown to dark grayish brown in a hue of 10YR or 7.5YR. Texture ranges from silt loam to loam that contains 10 to 15 percent gravel in places. Thickness ranges from 6 to 20 inches. The B2t horizon ranges from brown to dark grayish brown in hues of 7.5YR and 10YR. This horizon ranges from heavy loam to heavy silt loam and is about 10 percent gravel. The C horizon ranges from pale brown to light yellowish brown or to light brownish gray in a hue of 10YR or 2.5Y. It ranges from very cobbly very fine sandy loam to very cobbly fine sandy loam and is about 60 to 80 percent cobblestones and gravel. Depth to a distinct horizon of carbonate accumulation ranges from about 20 to 30 inches.

Permeability is moderate. This soil holds about 6 to 8 inches of available water to a depth of 5 feet. Roots extend to a depth of 5 feet or more. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Hendricks silt loam, 10 to 20 percent slopes, and Elzinga silt loam, 6 to 30 percent slopes.

This Clegg soil is used for range, watershed, and wildlife habitat. (Capability unit VIe-MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3)

Cluff Series

The Cluff series consists of well-drained soils. These soils formed in residuum and colluvium derived from sandstone, shale, and quartzite. They are on mountains at elevations of 7,200 to 8,500 feet. Slopes range from 6 to 30 percent. The vegetation is Douglas-fir, alpine fir, and some aspen. Average annual precipitation is 25 to 35 inches and is mostly snow. The mean annual air temperature ranges for 36° to 42° F., and the mean soil temperature is less than 59°. Cluff soils are associated with Scout, Lucky Star, Agassiz, and Hoskin soils.

In a representative profile, the surface layer is dark-brown or brown, medium acid to slightly acid silt loam about 9 inches thick. The subsurface layer is light-brown, medium acid very gravelly loam about 15 inches thick. Below this is light reddish-brown very gravelly clay loam about 7 inches thick. The subsoil is reddish-yellow, strongly acid very gravelly clay to a depth of 60 inches or more.

Cluff soils are used mainly for watershed and wildlife habitat. Some areas are used for wood products and some range.

Cluff silt loam, 6 to 30 percent slopes (CGE).—This soil is on mountains east of Hardware Ranch in the Baxter Sawmill area.

Representative profile of Cluff silt loam, 6 to 30 percent slopes, 1,200 feet south and 200 feet west of the northeast corner of sec. 9, T. 10 N., R. 4 E.:

O1—2½ to 2 inches, fir needles.

O2—2 inches to 0, partly decomposed litter that is mostly fir needles.

A11—0 to 4 inches, dark-brown to brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and nonplastic; many fine, medium, and large roots; medium acid; clear, wavy boundary.

A12—4 to 9 inches, brown (7.5YR 5/3) silt loam, dark brown (7.5YR 3/3) when moist; weak, coarse, subangular blocky structure that parts to fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine, medium, and large roots; common, very fine, discontinuous, random and inped interstitial pores; thick, continuous, light-colored coatings; slightly acid; clear, wavy boundary.

A22—9 to 24 inches, light-brown (7.5YR 6/3) very gravelly loam, brown (7.5YR 4/3) when moist; weak, coarse, subangular blocky structure that parts to medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common, fine and medium roots and few large roots; common, very fine, discontinuous, random and inped interstitial pores; 65 percent gravel; medium acid; diffuse, wavy boundary.

A2&B2t—24 to 31 inches, about 60 percent of this horizon is similar to the A22 horizon and the 40 percent B2t part is light reddish-brown (5YR 6/4) very gravelly clay loam, light reddish brown (5YR 6/4) when moist; moderate, coarse, fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots and few large roots; common, very fine, discontinuous, random inped and interstitial pores; common thin clay films in pores; thick, light-colored coatings on peds; 60 percent gravel; strongly acid; clear, wavy boundary.

B2t—31 to 62 inches; reddish-yellow (5YR 6/6) very gravelly light clay, yellowish red (5YR 4/6) when moist; moderate, coarse to fine, subangular blocky structure; very hard, very firm, sticky and very plastic; few fine, medium, and large roots; common, very fine, discontinuous. random inped, interstitial, and tubular pores; common moderately thick clay films; moderate, patchy, light-colored coatings; 50 percent gravel; strongly acid.

The thickness of the O horizon ranges from 2 to 4 inches. The combined thickness of the A1, A2, and B2t horizons ranges from 40 to 60 inches. Coarse fragments are mainly cobblestones and gravel-size angular rock fragments; their content ranges from 5 to 50 percent in the A1 horizon, from 20 to 60 percent in the A2 horizon, and from 50 to 90 percent in the B2t horizon. The A1 horizon has a hue of 10YR or 7.5YR. Texture is very fine sandy loam. Thickness ranges from 6 to 9 inches. The A2 horizon ranges from light brown to reddish yellow or pale brown in a hue of 10YR or 7.5YR. Texture ranges from very gravelly loam to gravelly very fine sandy loam. Reaction ranges from slightly acid to strongly acid. Thickness ranges from 6 to 18 inches. The B2t horizon ranges from reddish yellow to reddish brown or strong brown in hues of 7.5YR, 5YR, and 2.5YR. Texture ranges from very cobbly clay or very gravelly clay to very gravelly heavy clay loam. Reaction ranges from medium acid to strongly acid.

Permeability is moderate. This soil holds 5 to 7 inches of available water to a depth of 5 feet. Roots extend to a depth of 5 feet or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Lucky Star silt loam, 6 to 30 percent slopes, which is under aspen.

This Cluff soil is used mainly as woodland and for watershed and wildlife habitat. Some areas are grazed by sheep. (Capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4)

Cluff-Lucky Star association (6 to 30 percent slopes) (CHE).—This mapping unit consists of soils mainly at the head of Hyrum Dry Canyon. About 60 percent of the association is Cluff silt loam, 6 to 30 percent slopes; 25 percent is Lucky Star silt loam, 6 to 30 percent slopes; and about 15 percent is included soils.

The Cluff and Lucky Star soils are on all exposures on mountains. The slopes are dominantly 10 to 20 percent. The landscape is rough and broken. The rock formations are tilted, and there are long, narrow, limestone and sandstone ridges that are oriented in a generally north-south direction. The dominant vegetation is conifers and some aspen. The Cluff soil is mainly under conifers, and the Lucky Star soil is mainly under aspen.

Included in mapping were areas of Agassiz rocky silt loam, 6 to 30 percent slopes, and Obray silty clay, 6 to 20 percent slopes. The Agassiz soil makes up about 10 percent of the total acreage in the association, and the Obray soil about 5 percent.

Soils of this mapping unit are used as woodland, for watershed, for wildlife habitat, and for range. (Cluff soil is in capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4. Lucky Star soil is in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Cluff-Scout association (6 to 40 percent slopes) (CIE).—This mapping unit consists of soils east of Hardware Ranch in the vicinity of Baxters Mill. About 70 percent of the association is Cluff silt loam, 6 to 30 percent slopes; 20 percent is Scout gravelly loam, 10 to 40 percent slopes; and 10 percent is included soils.

The Cluff soil is on all exposures on broad mountains. The Scout soil is commonly on ridges and very steep sides of ridges. A representative profile for the Scout soil is described under the Scout series. Generally, both soils are under Douglas-fir and alpine fir.

Included in mapping were areas of Scare silt loam, 10 to 30 percent slopes, and of Lucky Star silt loam, 6 to 30 percent slopes. Also included were a few outcrops of limestone bedrock at the bottom of mountain sides near the edges of deep canyons.

Soils of this mapping unit are used mainly for watershed, for wildlife habitat, and as woodland, but some areas are grazed by sheep. The wood products are used extensively. (Capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4)

Collett Series

The Collett series consists of somewhat poorly drained soils that formed in mixed, calcareous, lake sediment derived principally from limestone, sandstone, and shale. These soils are on medium and low lake terraces at elevations of 4,450 to 4,700 feet. Slopes range from 0 to 3 percent. The vegetation is foxtail, Kentucky bluegrass, saltgrass, and some sedges and wiregrass. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 45° and 48° F. and the frost-free season is 120 to 140 days. Collett soils are most commonly associated with Greenson, Nibley, Logan, Salt Lake, and Cardon soils.

In a representative profile, the surface layer is gray, mildly alkaline silty clay loam about 12 inches thick. The subsoil is gray to light-gray, moderately alkaline heavy silty clay loam about 5 inches thick. The substratum, to a depth of 60 inches or more, is white, moderately alkaline, strongly calcareous heavy silty clay loam that contains a horizon of carbonate accumulation.

Collett soils are used for irrigated crops and for unimproved meadow and pasture.

Collett silty clay loam (0 to 3 percent slopes) (Ck).—This soil is on the broad, smooth or slightly undulating, low lake terraces throughout Cache Valley.

Representative profile, in a cultivated area 1½ miles south of the Logan-Cache Airport, 1,000 feet south and 1,000 feet east of the northwest corner of the southwest quarter of sec. 21, T. 12 N., R. 1 E.:

Ap—0 to 7 inches, gray (10YR 5/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, sticky and plastic; few fine roots; few fine pores; moderately calcareous; mildly alkaline; clear, smooth boundary.

A1—7 to 12 inches, gray (10YR 5/1) heavy silty clay loam, very dark gray (10YR 3/1) when moist; very weak, medium, prismatic structure that parts to moderate, fine, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; slightly calcareous; mildly alkaline; clear, smooth boundary.

B2—12 to 17 inches, gray to light-gray (10YR 6/1) heavy silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, prismatic structure that parts to moderate, fine, subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; few fine pores; moderately calcareous; moderately alkaline; clear, smooth boundary.

C1ca—17 to 24 inches, white (2.5Y 8/2) heavy silty clay loam, light brownish gray (10YR 6/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few medium and fine pores; strongly calcareous; moderately alkaline; clear, smooth boundary.

C2ca—24 to 34 inches, white (2.5Y 8/2) heavy silty clay loam, pale brown (10YR 6/3) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few fine roots; few fine pores; very strongly calcareous; moderately alkaline; abrupt, smooth boundary.

C3—34 to 60 inches, white (10YR 8/2) heavy silty clay loam, pale brown (10YR 6/3) when moist; common, medium, distinct, olive (5Y 5/6) or yellowish-brown (10YR 5/8) mottles; moderate, thin, platy structure; laminated lake sediment; hard, friable, slightly sticky and plastic; few fine roots; strongly calcareous; moderately alkaline.

The A horizon ranges from gray to dark gray. Texture ranges from heavy silty clay loam to heavy silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is slightly to moderately calcareous. Thickness ranges from 7 to 12 inches. The B2 horizon has a hue of 10YR or 2.5Y. Texture ranges from heavy silty clay loam to light silty clay. Reaction is mildly alkaline to moderately alkaline, and the horizon is slightly calcareous to moderately calcareous. Calcium carbonate equivalent in the Cca horizon is 22 to 60 percent. The C horizon ranges from white to pale brown or light gray. Texture ranges from silt loam to silty clay. Few to common, medium, distinct, yellowish-brown to strong-brown mottles are at a depth of more than 24 inches. A horizon of lime accumulation is in the upper part of the substratum at a depth of 16 to 22 inches. In places it is weakly cemented.

This soil is slightly difficult to till. Permeability is slow. This soil holds from 10 to 12 inches of available water to a 5-foot depth. In undrained areas the water table is at a depth of 20 to 36 inches, but in drained areas it is at a depth of 40 to 60 inches. Roots are mainly above the water table, but in drained areas they extend to a depth of 48 inches or more. Runoff is slow, and the hazard of erosion is none to slight.

Included in mapping were small areas of Greenson loam, 0 to 3 percent slopes. Also included were small areas of soils slightly affected by salt and alkali and areas of poorly drained soils.

Much of this Collette soil is drained; both tile and open drain systems are used. Irrigated crops are alfalfa, small grain, sugar beets, pasture, and corn for silage. Areas that have not been drained are used for wet meadow and pasture. (Capability unit IIIw–25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Collinston Series

The Collinston series consists of well-drained soils that formed in mixed sediment derived from light-colored tuff, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are strongly undulating or rolling and are on high lake terraces and terrace escarpments at elevations of 4,600 to 5,300 feet. Slopes range from 1 to 30 percent. The vegetation is dominantly bluebunch wheatgrass, cheatgrass, prairie junegrass, slender wheatgrass, Great Basin wildrye, Sandberg bluegrass, balsamroot, and aster. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 110 to 160 days. Collinston soils are most commonly associated with Mendon, Wheelon, Crookston, Avon, and Blackrock soils.

In a representative profile, the surface layer is gray, mildly alkaline loam about 15 inches thick. The underlying layer, to a depth of 60 inches or more, is white to very pale-brown, mildly alkaline to moderately alkaline, strongly calcareous silt loam or clay loam.

Collinston soils are used for dryfarming or for range.

Collinston loam, 6 to 10 percent slopes (CmD).—This undulating soil is on lake terraces. It is most commonly along the west side of Cache Valley in close association with Wheelon and Mendon soils, but some areas are south of Hyrum and east of Richmond.

Representative profile, in a cultivated area 1 mile west of Petersboro railroad warehouse, about 1,100 feet south and 900 feet west of the north quarter corner of sec. 19, T. 12 N., R. 1W.:

A11—0 to 8 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and medium roots; many fine pores; moderately calcareous; mildly alkaline; abrupt, smooth boundary.

A12—8 to 15 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many medium and fine pores; moderately calcareous; mildly alkaline; abrupt, smooth boundary.

C1ca—15 to 25 inches, white (10YR 8/2) clay loam, light gray (10YR 7/2) when moist; weak, fine, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many fine roots; many fine pores and few medium pores; very strongly calcareous; mildly alkaline; diffuse, smooth boundary.

C2—25 to 35 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; common fine pores; strongly calcareous; moderately alkaline; abrupt, irregular boundary.

C3—35 to 60 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; few, medium, distinct, yellowish-red (5Y 4/8) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine pores; strongly calcareous; moderately alkaline.

The A1 horizon ranges from gray to dark gray in hues of 10YR and 2.5Y. Texture ranges from loam to silt loam or light silty clay loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. Thickness ranges from 7 to 15 inches. The C horizon ranges from white to light gray or light brownish gray. Texture ranges from clay loam to silty clay loam or silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is strongly calcareous to very strongly calcareous. Some lime has been leached from the A horizon and redeposited in the upper part of the C horizon. In some places, partially weathered shale and cobblestones are in the C horizon at depths below 40 inches. In some places there are distinct, yellowish-brown or yellowish-red mottles below a depth of 30 inches.

This soil is fairly easy to till. Permeability is moderate. This soil holds 8 to 10 inches of available water to a depth of 5 feet. Roots penetrate easily to depths of about 48 inches. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of a soil that has a gravelly loam or cobbly loam surface layer.

This soil is used for dryland crops of small grain, alfalfa, and alfalfa-grass mixtures. (Capability unit IVe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Collinston loam, 1 to 6 percent slopes (CmC).—This soil is on medium lake terraces, mainly in the Clarkston-Petersboro area. It is similar to Collinston loam, 6 to 10 percent slopes, except that it has slopes of 1 to 6 percent and the surface layer is 8 to 18 inches thick. Runoff is slow to medium, and the hazard of erosion is slight.

Included with this soil in mapping were small areas of Mendon silt loam, 3 to 6 percent slopes, and small areas of a Collinston silt loam that has slopes of 6 to 10 percent.

This soil is used mostly for dryland crops of winter wheat, alfalfa, and alfalfa-grass mixtures. (Capability unit IIIe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Collinston loam, 10 to 30 percent slopes, eroded (CmE2).—This soil is on high lake terraces, mainly in the Clarkston-Petersboro area. It is closely associated with Collinston loam, 6 to 10 percent slopes, and is similar to that soil except that it is steeper and the surface layer is 7 to 8 inches thick. In places, partly weathered shale and cobblestones are at a depth below 40 inches. Runoff is rapid, and the hazard of further erosion is high. This soil is moderately eroded.

Included in mapping were areas of Wheelon silt loam, 10 to 30 percent slopes, eroded; small areas of Mendon silt loam, 6 to 10 percent slopes, eroded; and small areas of Mendon silt loam, 6 to 10 percent slopes.

About 60 percent of the acreage is used for dryland crops of winter wheat, alfalfa, and alfalfa-grass mixtures. The remaining 40 percent is used for range that is grazed after crops in adjacent areas have been harvested. (Capability unit VIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Collinston loamy fine sand, 0 to 3 percent slopes (ClA).—This soil is on medium lake terraces north of the Newton cemetery. Slopes are slightly undulating.

The texture of the profile ranges from loamy fine sand to fine sandy loam in places. The surface layer ranges from 6 to 20 inches in thickness.

Included in mapping were small areas of a soil that has slopes of slightly more than 3 percent, and a few small areas of Crookston loam, 0 to 3 percent slopes.

This Collinston soil is easy to work and can be cultivated within a wide range of moisture content. It is somewhat excessively drained and is rapidly permeable. Runoff is very slow. The hazard of erosion is only moderate, but soil blowing is a major hazard. This soil holds 5 to 6 inches of available water to a depth of 5 feet. Sand ridges along fence rows are common.

Most of the acreage is used for dryland crops of alfalfa and winter wheat. A small acreage is sprinkler irrigated; sugar beets, alfalfa, and some corn for silage are grown. (Capability unit IIIs–24, irrigated, IIIs–U4, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crookston Series

The Crookston series consists of well-drained soils that formed in mixed lake sediment derived dominantly from light-colored tuff, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are on medium and high lake terraces at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 10 percent. The vegetation is dominantly big sagebrush, bluebunch wheatgrass, western wheatgrass, and balsamroot. The average annual precipitation is 15 to 17 inches. The mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 150 days. Crookston soils are most commonly associated with Mendon, Avon, Collinston, and Wheelon soils.

In a representative profile, the surface layer is gray, mildly alkaline loam about 14 inches thick. The subsoil is grayish-brown, mildly alakline loam about 13 inches thick. The substratum, to a depth of 60 inches, is light-gray, strongly calcareous, mildly alkaline loam and fine sandy loam. Most carbonates have been leached from the surface layer and upper part of the subsoil and redeposited at depths of 20 to 28 inches to form a distinct lime horizon.

Crookston soils are used mainly for dryland crops of alfalfa and small grain. Where water is available, some areas are irrigated.

Crookston loam, 0 to 3 percent slopes (CoA).—This soil is on the medium lake terraces. It is generally on the west side of Cache Valley between the towns of Mendon and Clarkston.

Representative profile, in a cultivated field about 2 miles north and ½ mile west of Newton, 500 feet north and 40 feet east of the southwest corner of sec. 6, T. 13 N., R. 1 W.:

Ap—0 to 6 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure and weak, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; many fine roots; noncalcareous, mildly alkaline; abrupt, smooth boundary.

A1—6 to 14 inches, gray (10YR 5/1) loam, very dark gray (10 YR 3/1) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine roots; common fine pores; noncalcareous; mildly alkaline; clear, smooth boundary.

B2t—14 to 27 inches, grayish-brown (10YR 5/2) loam, very dark gray (10YR 3/1) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine and medium pores; common thin clay films; noncalcareous; mildly alkaline; clear, wavy boundary.

C1ca—27 to 48 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine and medium pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C2ca—48 to 60 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; many fine and medium pores; strongly calcareous; mildly alkaline.

The A horizon ranges from gray to dark gray. Its texture is loam, silt loam, or fine sandy loam. The horizon is as much as 5 percent gravel in places. Thickness ranges from 10 to 18 inches. The B2t horizon ranges from grayish brown to gray or dark gray. Texture ranges from loam to silt loam. The C and Cca horizons range from light gray to white or pale yellow in hues ranging from 10YR to 5Y. Texture ranges from clay loam to fine sandy loam. The Cca horizon has a calcium carbonate equivalent of 25 to 35 percent.

This soil is easy to till. Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 4 to 6 feet.

Included in mapping were small areas of Mendon silt loam, 0 to 3 percent slopes.

All the acreage of this Crookston soil is cultivated. About 75 percent of the acreage is used for dryland crops of alfalfa, winter wheat, and safflower. The remaining 25 percent is used for irrigated crops of alfalfa, small grain, pasture, sugar beets, and corn for silage. (Capability unit IIc–2, irrigated, IIIe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crookston loam, 3 to 6 percent slopes (CoB).—This slightly undulating soil is on lake terraces along the west side of Cache Valley, between the towns of Mendon and Clarkston. It is similar to Crookston loam, 0 to 3 percent slopes, except that it has slopes of 3 to 6 percent, its surface layer is only 7 to 12 inches thick, and its subsoil is only 6 to 12 inches thick. Runoff is slow to medium, and the hazard of erosion is slight.

Included in mapping were a few small areas of soil that has slopes of 6 to 10 percent, and small areas of Collinston loam, 1 to 6 percent slopes.

All the acreage of this Crookston soil is cultivated. About 75 percent of the acreage is used for dryland crops of alfalfa and winter wheat. The remaining 25 percent is used for irrigated crops of alfalfa and small grain. (Capability unit IIe–2, irrigated, IIIe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crookston loam, 6 to 10 percent slopes (CoC).—This soil is on high lake terraces. It is similar to Crookston loam, 0 to 3 percent slopes, except that it is steeper, its surface layer is only 7 to 10 inches thick, and its subsoil is only 4 to 12 inches thick. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were a few small areas of a soil that has slopes of 3 to 6 percent, and small areas of Collinston loam, 6 to 10 percent slopes.

This Crookston soil is used mostly for dryland crops of alfalfa and winter wheat, but a few small areas are irrigated. (Capability unit IIIe–2, irrigated, IIIe–UE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crowshaw Series

The Crowshaw series consists of well-drained soils that formed in alluvium derived mainly from sandstone. These soils are on old alluvial fans deposited on high lake terraces at elevations of 4,500 to 5,000 feet. Slopes range from 3 to 20 percent. The vegetation is blue bunch wheatgrass, western wheatgrass, big sagebrush, and balsamroot. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Crowshaw soils are most commonly associated with Hendricks, Dagor, and Timpanogos soils.

In a representative profile, the surface layer is very dark grayish brown, slightly acid gravelly loam about 16 inches thick. The subsoil is dark-brown to brown, slightly acid gravelly loam about 14 inches thick. The substratum is brown, slightly acid gravelly loam to a depth of 60 inches or more.

Crowshaw soils are used for dry cropland.

Crowshaw gravelly loam, 6 to 10 percent slopes (CrC).—This soil is on old alluvial fans extending from the town of Mendon south almost to Sardine Canyon.

Representative profile, 1½ miles south of Mendon, 1,400 feet south of the northwest corner of the northeast quarter of sec. 20, T. 11 N., R. 1 W.:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine and medium pores; 15 percent gravel; slightly acid; clear, wavy boundary.

A1—10 to 16 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine roots; common fine and medium pores; 15 percent gravel; slightly acid; clear, wavy boundary.

B2—16 to 30 inches, dark-brown to brown (10YR 4/3) gravelly loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; common thin clay films in pores and on some peds; 15 percent gravel; slightly acid; clear, wavy boundary.

C—30 to 60 inches, brown (7.5YR 5/4) gravelly loam, dark brown to brown (7.5YR 4/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; 20 percent gravel; slightly acid.

The A horizon ranges from very dark grayish brown to dark grayish brown and is 10 to 20 percent gravel. Reaction is slightly acid to neutral. Thickness ranges from 8 to 16 inches. The B horizon ranges from dark brown to brown or to grayish brown in a hue of 7.5YR or 10YR. The horizon is gravelly loam to gravelly heavy loam and is 15 to 25 percent gravel. The C horizon ranges from brown to yellowish brown or to pale brown in a hue of 7.5YR or 10YR. It is gravelly loam or very gravelly loam that is 15 to 35 percent gravel. A few angular cobblestones of sandstone and other stones commonly are below a depth of 30 inches. In places there is strongly calcareous lake sediment below a depth of 40 inches.

This soil is fairly easy to till, but the gravel causes excessive wear on tillage implements. Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds 7 to 9 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of Hendricks silt loam, 6 to 10 percent slopes.

This Crowshaw soil is used mostly for dryland crops of alfalfa and small grain. Controlling erosion is the most important concern in management. (Capability unit IIIe-2, irrigated, IIIe-UXE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crowshaw gravelly loam, 3 to 6 percent slopes (CrB).—This soil is on the lower parts of old alluvial fans along the foothills of the Wellsville Mountains. It is similar to Crowshaw gravelly loam, 6 to 10 percent slopes, except that it has slopes of 3 to 6 percent and the surface layer is 12 to 19 inches thick. Runoff is slow to medium, and the hazard of erosion is slight.

Included in mapping were small areas of soil that is not gravelly, and a few small areas of Hendricks silt loam, 3 to 6 percent slopes. Also included were a few small areas of soil that has slopes of slightly less than 3 percent.

This Crowshaw soil is used for dryland crops of alfalfa and winter wheat. (Capability unit IIe-2, irrigated, IIIe-UX, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crowshaw gravelly loam, 10 to 20 percent slopes (CrD).—This soil is on alluvial fans and is associated with Hendricks silt loams and other Crowshaw soils. It is similar to Crowshaw gravelly loam, 6 to 10 percent slopes, except that the surface layer is only 7 to 14 inches thick. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of soils that have an accumulation of cobblestones or stones on the surface. Also included are a few small areas where slopes are slightly more than 20 percent.

This soil is used mostly for dryland crops of alfalfa and winter wheat. A few small areas are used as range. (Capability unit IVe-UX, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Curtis Creek Series

The Curtis Creek series consists of well-drained soils that formed in residuum derived from sandstone. These soils are 13 to 20 inches deep over fractured bedrock. They are on mountains at elevations of 6,000 to 8,000 feet. Slopes range from 10 to 60 percent. The vegetation is dominantly bluebunch wheatgrass, Columbia needlegrass, slender wheatgrass, Great Basin wildrye, native bluegrass, big sagebrush, and yellowbrush. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 38° to 42° F., and the frost-free season is 80 to 100 days. Curtis Creek soils are most commonly associated with Hoskin, Goring, Lucky Star, and Ant Flat soils.

In a representative profile, the surface layer is brown to dark-brown, medium acid loam about 8 inches thick. The subsoil is reddish-brown to yellowish-red slightly acid to neutral heavy loam or light sandy clay loam about 10 inches thick over fractured sandstone bedrock.

Curtis Creek soils are used for range, watershed, and wildlife habitat.

Curtis Creek-Goring association, hilly (6 to 30 percent slopes) (CSE).—This mapping unit consists of soils on mountains that have spur ridges in the Curtis Creek-Mollens Hollow area east of Hardware Ranch. The general aspect is dominantly south, but some exposures face east and west. About 65 percent of the association is Curtis Creek loam, 10 to 30 percent slopes; 25 percent is Goring silt loam, 6 to 10 percent slopes; and about 10 percent is included soils.

The Curtis Creek soil is dominantly moderately steep and is on ridges. The Goring soil is moderately steep in concave areas and swales. The vegetation on both soils is shrubs and grass.

Representative profile of Curtis Creek loam, 6 to 30 percent slopes, in an area of Curtis Creek-Goring association, hilly, 1,300 feet north and 1,200 feet west of southeast corner of sec. 19, T. 10 N., R. 4 E.:

A1—0 to 8 inches, brown to dark-brown (7.5YR 4/3) loam, very dark brown (7.5YR 2/2) when moist; moderate, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; many fine and very fine roots and a few medium roots; medium acid; clear, smooth boundary.

B21t—8 to 12 inches, reddish-brown (5YR 4/4) heavy loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, subangular blocky and angular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; few, fine, discontinuous, random, inped pores; common thin clay films on peds and in pores; 10 percent gravel; slightly acid; clear, wavy boundary.

B22t—12 to 18 inches, yellowish-red (5YR 5/6) light sandy clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine and medium roots; common, fine, discontinuous, random pores; common thin clay films on ped surfaces and in pores; neutral; abrupt, smooth boundary.

R—18 inches, light-red (2.5YR 6/6) fractured and weathering calcareous sandstone, red (2.5YR 4/6) when moist.

The A1 horizon ranges from brown to dark brown or reddish brown in hues of 10YR to 5YR. Texture is dominantly loam but ranges to cobbly loam. In places the A horizon is as much as 20 percent cobblestones and gravel. Reaction is medium acid to neutral. Thickness ranges from 8 to 11 inches. The B2t horizon ranges from reddish brown or yellowish red to red in hues of 5YR and 2.5YR. It ranges from loam to light clay loam and in places is as much as 20 percent gravel.

Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. These soils hold 3.5 to 4 inches of available water above the bedrock. Some roots extend into cracks in the bedrock, but most roots are within a depth of 20 inches.

Included in mapping were areas of Hoskin cobbly loam, 10 to 30 percent slopes; Agassiz rocky silt loam, 6 to 30 percent slopes; and Lucky Star silt loam, 6 to 20 percent slopes. The Hoskin and Agassiz soils are on spur ridges. The Lucky Star soil has slopes that face east, and the vegetation on it is aspen.

Soils in this mapping unit are used for range, watershed, and wildlife habitat. (Curtis Creek soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. Goring soil is in capability unit VIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Curtis Creek-Goring association, steep (30 to 60 percent slopes) (CSG).—This mapping unit consists of soils in the vicinity of Rock Creek, northeast of Hardware Ranch. About 50 percent of the association is Curtis Creek loam, 30 to 60 percent slopes; 25 percent is Goring silt loam, 30 to 60 percent slopes; 20 percent is Lucky Star gravelly silt loam, 30 to 60 percent slopes; and about 5 percent is included soils. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

The Curtis Creek soil is in very steep mountain areas that face south, east, and west. The surface layer is 8 to 10 inches thick. The vegetation is sagebrush and grass.

The topography of the Goring soil is generally the same as the Curtis Creek soil, except that the soil is in concave areas.

The Lucky Star is on north-facing slopes of mountains. The vegetation is aspen.

Included in mapping were areas of Curtis Creek loam, 10 to 30 percent slopes, and areas of rock outcrop.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Curtis Creek soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. Goring soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3. Lucky Star soil is in capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; not in a woodland suitability group; wildlife suitability group 3)

Dagor Series

The Dagor series consists of well-drained soils that formed in recent alluvium that was derived from sandstone rocks and was washed from the eroded surface layer of the adjacent upland soils. Dagor soils are mainly on alluvial fans along the foothills on the east side of Wellsville Mountain. The elevation ranges from 4,900 to 5,150 feet. Slopes range from 4 to 20 percent. The vegetation is sagebrush, scrubby maple, and wheatgrasses. The average annual precipitation is 17 to 18 inches, the mean annual air temperature is 46° to 47° F., and the frost-free season is 120 to 140 days. Dagor soils are most commonly associated with Crowshaw and Hendricks soils.

In a representative profile, the soil is dark grayish-brown to brown, slightly acid to neutral silt loam that extends to a depth of 60 inches or more.

Dagor soils are used for dryland crops of alfalfa and small grain.

Dagor silt loam, 10 to 20 percent slopes (DaD).—This soil is on the upper part of alluvial fans, mostly south of the town of Wellsville.

Representative profile, 1,400 feet south and 500 feet west of the northeast corner of the northwest quarter of sec. 27, T. 10 N., R. 1 W.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; common medium and fine roots; few medium pores; neutral; clear, smooth boundary.

A11—5 to 14 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and plastic; many fine roots; common fine and medium pores; slightly acid; gradual, wavy boundary.

A12—14 to 34 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky structure; soft, friable, nonsticky and slightly plastic; many fine roots; few large pores and common medium pores; neutral; gradual, wavy boundary.

AC—34 to 46 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) when moist; weak, fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; common medium pores and many fine pores; slightly acid; clear, wavy boundary.

C—46 to 60 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and plastic; common fine roots; common medium pores and many fine pores; neutral.

The A horizon ranges from dark grayish brown to brown. Its texture is silt loam to loam. Thickness ranges from 20 to 36 inches. The C horizon ranges from brown to yellowish brown in hues of 7.5YR and 10YR. It is silt loam to loam and in places is as much as 40 percent gravel. Reaction is slightly acid to neutral.

This soil is easy to till. Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of a soil that has slopes of 5 to 10 percent and a few small areas of a soil that has slopes of slightly more than 20 percent.

This Dagor soil is used almost entirely for dryland crops of alfalfa and winter wheat. (Capability unit IVe–2, irrigated, IVe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Dagor silt loam, 4 to 8 percent slopes (DaC).—This soil is on the lower part of alluvial fans along the foothills of the Wellsville Mountains. In places the substratum, below a depth of 36 inches, is as much as 40 percent sandstone gravel. The pebbles are mostly less than 1 inch in diameter. In places small amounts of gravel are scattered throughout the profile. Runoff is slow to medium, and the hazard of erosion is slight.

Included in mapping were small areas of Hendricks silt loam, 3 to 6 percent slopes, and Crowshaw gravelly loam, 3 to 6 percent slopes. Also included were small areas of gravelly and cobbly soils that are on the upper part of fans.

This Dagor soil is used almost entirely for dryland crops of alfalfa and winter wheat. (Capability unit IIIe–2, irrigated, IIIe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Dateman Series

The Dateman series consists of well-drained soils that formed in residuum and colluvium derived from limestone. These soils are underlain by bedrock at a depth of 26 to 40 inches. They are steep to very steep and are on north- and east-facing slopes at elevations of 6,200 to 9,000 feet. Slopes range from 40 to 70 percent. The vegetation is Douglas-fir and alpine fir. The average annual precipitation is 25 to 35 inches, the mean annual air temperature is 35° to 40° F., and the mean soil temperature in summer is less than 60°. The frost-free season is 70 to 90 days. Dateman soils are most commonly associated with Agassiz, Bradshaw, Smarts, Elwood, and Lucky Star soils.

In a representative profile, the surface layer is dark-brown to brown, neutral cobbly silt loam about 24 inches thick. The subsoil is brown to dark-brown, mildly alkaline very cobbly silty clay loam about 10 inches thick. Limestone bedrock is at a depth of about 34 inches.

Representative profile of Dateman cobbly silt loam in an area of Agassiz-Dateman association, eroded, in Paradise Dry Canyon, 1,700 feet east of the west quarter corner of sec. 5, T. 9 N., R. 2 E.:

O1—2 inches to 0, decomposing needles and twigs.

A11—0 to 14 inches, dark-brown to brown (10YR 4/3) cobbly silt loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many fine roots, common medium roots, and few large roots; 20 percent cobblestones; neutral; gradual, wavy boundary.

A12—14 to 24 inches, brown (10YR 5/3) cobbly heavy silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots and few medium and large roots; 40 to 50 percent cobblestones; neutral; gradual, irregular boundary.

B2—24 to 34 inches, brown to dark-brown (7.5YR 4/4) very cobbly light silty clay loam, dark brown (7.5YR 3/4) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and plastic; few fine, medium, and large roots; many very fine, discontinuous, interstitial pores; few thin clay films in pores and on ped surfaces; 70 percent cobblestones; noncalcareous; mildly alkaline; abrupt, irregular boundary.

R—34 inches, fractured weathering limestone bedrock that has some B2 material in the larger cracks and accumulations of calcium carbonate on the undersides of rock fragments.

The combined thickness of the A1 and B2t horizons over the fractured limestone bedrock ranges from 26 to 40 inches. The content of cobblestones and gravel generally increases with increasing depth.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. These soils hold 4 to 5 inches of available water above the bedrock. Roots are mostly within a depth of 27 to 40 inches, but some extend into cracks in the bedrock.

Dateman-Bradshaw association (30 to 70 percent slopes) (DHG).—This mapping unit consists of soils in the vicinity of Davenport Creek on mountains that have many spur ridges. About 60 percent of the association is Dateman cobbly silt loam, 40 to 70 percent slopes; 30 percent is Bradshaw silt loam, 30 to 60 percent slopes; and about 10 percent is included soils.

The Dateman soil is steep and very steep, and it has north- and east-facing slopes. The Bradshaw soil is in slightly concave areas between spur ridges.

Included in mapping were areas of Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and Mult silt loam, 30 to 50 percent slopes. The Agassiz soil is on convex ridges, where the vegetation is curlleaf mountain-mahogany and various browse plants. The Mult soil is in concave areas, where the vegetation is aspen.

Soils of this mapping unit are used for range, wildlife habitat, woodland, and watershed. (Dateman soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4. Bradshaw soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Dateman extremely rocky silt loam, 40 to 80 percent slopes (DEG).—This very steep mapping unit is on north-facing canyon walls that dissect mountains, mostly in the Blacksmith Fork Canyon and on the Wellsville Mountains. It is about 40 to 60 percent Dateman cobbly silt loam, 40 to 70 percent slopes; 30 percent Rock land and rock outcrop; and 10 percent included soils.

The Dateman soil is in slightly concave areas between areas of Rock land and rock outcrop. This soil is similar to Dateman cobbly silt loam, 40 to 70 percent slopes, described under the series. Slopes are dominantly 60 to 70 percent. The vegetation is Douglas-fir and alpine fir and a sparse understory of chokecherry, snowberry, Oregon grape, and mountain-myrtle.

Rock land and rock outcrop are dominantly limestone. Rock land has slopes of 60 to 80 percent or more. Some of the rock outcrop is in perpendicular cliffs, and rock ledges are common.

Included in mapping were areas of Agassiz soils.

This soil is used for watershed and wildlife habitat. The wooded areas have not been used extensively, because the landscape is rough and harvesting is difficult. (Capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4x1; wildlife suitability group 4)

Datwyler Series

The Datwyler series consists of well-drained soils that formed in residuum and colluvium derived from limestone and calcareous sandstone rocks. These soils are on south- and west-facing mountain areas at elevations of 5,000 to 7,000 feet. Slopes range from 30 to 60 percent. The vegetation is bluebunch wheatgrass, native bluegrass, slender wheatgrass, lupine, big sagebrush, and serviceberry. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 40° to 45° F., and the frost-free season is 90 to 110 days. Datwyler soils are associated with Maughan, Elzinga, Sheep Creek, and Agassiz soils.

In a representative profile, the surface layer is brown, neutral cobbly silty clay loam about 4 inches thick. The subsoil is brown and reddish brown, neutral very cobbly clay about 24 inches thick. The substratum is pink, strongly calcareous, mildly alkaline very cobbly sandy clay loam. Bedrock is at a depth of about 35 inches. Carbonates have been leached from the surface layer and subsoil. A distinct horizon of carbonate accumulation is at a depth of 24 to 35 inches.

Datwyler soils are used for range, watershed, and wildlife habitat.

Datwyler cobbly silty clay loam, 30 to 60 percent slopes (DLG).—This soil is in south-facing mountain areas, mainly south and west of the town of Wellsville.

Representative profile, located 3 miles south of Wellsville, 300 feet west and 1,000 feet south of the north quarter corner of sec. 27, T. 10 N., R. 1 W:

A1—0 to 4 inches, brown (7.5YR 4/2) cobbly heavy silty clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and plastic; common fine and medium roots; 40 to 50 percent cobblestones and gravel; neutral; clear, wavy boundary.

B1—4 to 11 inches, brown (7.5YR 4/2) very cobbly clay, dark brown (7.5YR 3/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; common fine and medium interstitial and tubular pores; 60 percent cobblestones and gravel; neutral; clear, wavy boundary.

B2t—11 to 28 inches, reddish-brown (5YR 5/4) very cobbly clay, reddish-brown (5YR 4/4) when moist; moderate, medium, prismatic structure that parts to strong, medium, subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; few fine interstitial pores; thin continuous clay films; 70 percent cobblestones and gravel; neutral; clear, wavy boundary.

Cca—28 to 35 inches, pink (7.5YR 7/4) very cobbly sandy clay loam, light brown (7.5YR 6/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; 90 percent cobblestones and gravel; strongly calcareous; mildly alkaline.

R—35 inches, fractured limestone bedrock that has streaks of lime in cracks and on rocks.

The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Texture ranges from cobbly heavy silty clay loam to cobbly heavy loam. Reaction is slightly acid to neutral. Thickness ranges from 4 to 10 inches. The B1 horizon ranges from brown to dark brown. Texture is very cobbly heavy clay loam or very cobbly clay. The B2t horizon ranges from reddish brown to brown or strong brown in a dominant hue of 5YR or 7.5YR. Texture is dominantly very cobbly clay but ranges to very cobbly heavy clay loam. Reaction is slightly acid to neutral. The Cca horizon ranges from pink to light brown in a hue of 7.5YR or 5YR. Reaction ranges from mildly alkaline to strongly alkaline. The depth to limestone bedrock ranges from 32 to 40 inches. Pebbles and cobblestones are present throughout the profile and generally increase with depth. The content of coarse fragments ranges from 30 to 50 percent in the A1 horizon, 40 to 60 percent in the B1 horizon, 50 to 80 percent in the B2t horizon, and 70 to 95 percent in the C horizon.

Permeability is moderately slow. Runoff is rapid to very rapid and the hazard of erosion is high to very high. This soil holds 3 to 5 inches of available water above the bedrock. Most roots are above the bedrock, but some extend into cracks to depths of 4 feet or more.

Included in mapping were small areas of Sheep Creek cobbly loam, 30 to 70 percent slopes, and Agassiz cobbly silt loam, 30 to 60 percent slopes.

This Datwyler soil is used for range, watershed, and wildlife habitat. (Capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Datwyler-Elzinga-Maughan association (30 to 60 percent slopes) (DNG).—This mapping unit consists of soils in the foothills of mountains south of Wellsville and in areas on the north end of Wellsville Mountain. About 40 percent of the association is Datwyler cobbly silty clay loam; 30 percent is Elzinga silt loam, 30 to 60 percent slopes; 20 percent is Maughan silt loam, 30 to 60 percent slopes; and 10 percent is included soils.

The Datwyler soil mainly has slopes that face south, and the vegetation is mostly bluebunch wheatgrass, cheatgrass, sagebrush, balsamroot, bitterbrush, and yellowbrush. The Datwyler soil in this mapping unit is similar to Datwyler cobbly silty clay loam, 30 to 60 percent slopes.

The Elzinga and Maughan soils are very steep and mostly have slopes that face north. The Maughan soil is described under the Maughan series. Vegetation on these soils is dominantly maple, but there are scattered aspen trees and a sparse understory of chokecherry, wheatgrass, false Solomons-seal, and fern.

Included in mapping were areas of deep, gravelly, medium-textured soils that formed in alluvium.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Datwyler soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Elzinga and Maughan soils are in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. None of these soils is in a woodland suitability group. All are in wildlife suitability group 3)

Despain Series

The Despain series consists of well-drained soils that formed in residuum and colluvium derived from sandstone, quartzite, and limestone. These soils are in dominantly south- and west-facing mountain areas. In the Clarkston Mountain area, however, slopes face east and north. Elevations range from 5,500 to 8,000 feet. Slopes range from 20 to 70 percent. The vegetation is bluebunch wheatgrass, tall native bluegrass, big sagebrush, yellowbrush, bitterbrush, ceanothus, ninebark, and serviceberry. The average annual precipitation is 20 to 25 inches, the mean annual temperature is 38° to 44° F., and the frost-free season is 80 to 100 days. Despain soils are associated with Ant Flat, Lucky Star, Bickmore, and Sheep Creek soils.

In a representative profile, the surface layer is brown to dark-brown, slightly acid to neutral gravelly loam about 16 inches thick. The subsoil is brown to dark-brown, neutral gravelly clay loam about 14 inches thick. The substratum, to a depth of 60 inches or more, is reddish-yellow, strongly calcareous, mildly alkaline gravelly loam. Carbonates have been leached from the surface layer and upper part of the subsoil and redeposited in the lower part of the subsoil and the substratum.

Despain soils are used for range, wildlife habitat, and watershed.

Despain-Lucky Star association (30 to 70 percent slopes) (DSG).—This mapping unit consists of soils on mountains east of Ant Flat. About 60 percent of the association is Despain gravelly loam, 30 to 70 percent slopes; 30 percent is Lucky Star gravelly silt loam, 30 to 60 percent slopes; and about 10 percent is included soils.

The Despain soil is in broad, open, west- and south-facing areas, where the vegetation is shrubs and grasses. The Lucky Star soil is in north- and east-facing areas. Here, the vegetation is aspen.

Representative profile of Despain gravelly loam, 30 to 70 percent slopes, in an area of Despain-Lucky Star association, 8 miles south of Hardware Ranch and 1 mile east of the road, 200 feet west of the east quarter corner of sec. 26, T. 9 N., R. 3 E.:

A11—0 to 9 inches, brown to dark-brown (7.5YR 4/3) gravelly loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, very friable, non-sticky and slightly plastic; many fine, medium, and large roots; 20 percent gravel and cobblestones; slightly acid; gradual, wavy boundary.

A12—9 to 16 inches, brown to dark-brown (7.5YR 4/3) gravelly loam, very dark brown (7.5YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; many fine, medium, and large roots; many, fine, random, interstitial pores; 20 percent gravel and cobblestones; neutral; gradual, wavy boundary.

B21t—16 to 23 inches, brown to dark-brown (7.5YR 4/3) gravelly light clay loam, very dark brown (7.5YR 2/2) when moist; moderate, medium and coarse, subangular blocky structure that parts to weak, fine, subangular blocky structure; slightly hard, firm, slightly sticky and plastic; many fine and medium roots; many, fine, random, interstitial pores; thin continuous clay films; 30 percent gravel and cobblestones; neutral; gradual, wavy boundary.

B22t—23 to 30 inches, brown (7.5YR 5/4) gravelly light clay loam, dark brown (7.5YR 3/2) when moist; weak, coarse, subangular blocky structure that parts to weak, fine, subangular blocky structure; slightly hard, firm, slightly sticky and plastic; common fine and medium roots; many, fine, random, interstitial pores; common thin clay films; 30 percent gravel and cobblestones; neutral; gradual, wavy boundary.

Cca—30 to 60 inches, reddish-yellow (5YR 6/6) gravelly heavy loam, yellowish red (5YR 4/6) when moist; massive; slightly hard, firm, nonsticky and slightly plastic; few fine and medium roots; many fine pores; 40 percent gravel and cobblestones; strongly calcareous; mildly alkaline.

The combined thickness of the A1 and B2t horizons ranges from 24 to 38 inches over the Cca horizon. The A1 horizon ranges from brown to dark brown or reddish brown in a hue of 10YR, 7.5YR, or 5YR. This horizon ranges from gravelly loam to loam and is 10 to 30 percent gravel and cobblestones. Reaction ranges from slightly acid to mildly alkaline. Thickness ranges from 12 to 17 inches. The B2t horizon ranges from brown or dark brown to yellowish brown or reddish brown in a hue of 10YR, 7.5YR, or 5YR. Texture is cobbly and gravelly light clay loam or cobbly and gravelly heavy loam. Reaction is slightly acid to mildly alkaline. Thickness ranges from 8 to 20 inches. The Cca and C horizons range from reddish yellow to yellowish brown or brown in hues of 10YR to 5YR. Texture ranges from cobbly and gravelly loam to very cobbly and gravelly clay loam. Reaction is mildly alkaline to moderately alkaline. These horizons are moderately calcareous to strongly calcareous.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 6 to 9 inches of available water to a depth of 5 feet. Roots extend to a depth of 4 feet or more.

Included in mapping where areas of Scave silt loam, 10 to 30 percent slopes, and Sheep Creek cobbly loam, 30 to 70 percent slopes. The Scave soil is in north- and east-facing areas, where the vegetation is aspen. The Sheep Creek soil is in west-facing areas, where the vegetation is shrubs and grasses.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Despain soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3. Lucky Star is in capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2r1; wildlife suitability group 4)

Despain-Bickmore association (30 to 70 percent slopes) (DPG).—This mapping unit is on the east side of Clarkston Mountain. About 50 percent of it is Despain gravelly loam, 30 to 70 percent slopes; 35 percent is Bickmore gravelly silt loam, 30 to 60 percent slopes; and about 15 percent is included soils.

The Despain soil is in open areas, where the vegetation is brush, forbs, and grasses. The vegetation on the Bickmore soil is a dense stand of conifers but only a sparse understory.

Included in mapping were areas of Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, Picayune gravelly loam, 50 to 80 percent slopes, and Smarts gravelly loam, 30 to 70 percent slopes.

Soils of this mapping unit are used for range, wildlife habitat, and watershed. (Despain soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3. Bickmore soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Elwood Series

The Elwood series consists of well-drained soils that formed in residuum derived chiefly from limestone. These soils are on mountains at elevations of 7,500 to 9,000 feet. Slopes range from 10 to 60 percent. The vegetation is Douglas-fir, alpine fir, and Engelmann spruce. The average annual precipitation is 25 to 35 inches, the mean annual temperature is 32° to 42° F., and the mean soil temperature in summer is less than 60°. The frost-free season is 75 to 90 days. Elwood soils are associated with Mult, Dateman, and Agassiz soils.

In a representative profile, the surface layer is brown, medium acid heavy silt loam about 11 inches thick. The subsoil is brown, neutral cobbly and very cobbly silty clay loam about 27 inches thick. Fractured limestone is at a depth of about 38 inches.

The Elwood soils are used mainly for watershed and wildlife habitat. Wood products have been harvested in a few places.

Elwood silt loam, 30 to 60 percent slopes (EDG).—This soil is in dominantly north- and east-facing areas near the head of Paradise Dry Canyon and also in the vicinity of Beaver Mountain.

Representative profile, 2 miles south and 1 mile east of Beaver Mountain, about 2,000 feet north and 2,000 feet east of the southwest corner of sec. 20, T. 14 N., R. 4 E.:

O1—2 inches to 0, fir needles and twigs.

A1—0 to 11 inches, brown (10YR 5/3) heavy silt loam, dark brown (7.5YR 3/3) when moist; moderate, medium, subangular blocky structure that parts to moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots and few large roots; few, fine, discontinuous, random, inped pores; medium, acid; clear, wavy boundary.

B21t—11 to 26 inches, brown (7.5YR 5/4) cobbly silty clay loam, brown to dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and slightly plastic; common fine and medium roots; few, fine, discontinuous, random, inped pores; common thin clay films in pores and on ped surfaces; 20 percent cobblestones; neutral; clear, wavy boundary.

B22t—26 to 38 inches, brown (7.5YR 5/4) very cobbly light silty clay loam, brown to dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; few fine pores; common thin clay films; 80 percent cobblestones and gravel-size limestone rock fragments; neutral.

R—38 inches, fractured limestone.

The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. This horizon is dominantly heavy silt loam but is loam in places and has a gravel content of 5 to 20 percent. Reaction is slightly acid to medium acid. Thickness ranges from 10 to 12 inches. The B2t horizon ranges from brown to pale brown or light brown in a hue of 10YR or 7.5YR. Its texture ranges from cobbly silty clay loam to cobbly heavy loam in the upper part of the horizon to very cobbly silty clay loam in the lower part. The content of cobblestones and gravel is 20 to 50 percent in the upper part of the horizon and 50 to 80 percent in the lower part. Depth to bedrock is 20 to 40 inches.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 4 to 6 inches of available water above the bedrock. Roots are mostly above the limestone, but some roots extend into cracks in the rocks.

Included in mapping were areas of moderately deep, well-drained silty clay loam soils and areas of Agassiz rocky loam, 30 to 70 percent slopes, eroded. The silty clay loams make up 7 percent of the mapping unit, and the Agassiz soil makes up 3 percent.

This Elwood soil is used for watershed, woodland, and wildlife habitat. (Capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Elwood-Agassiz association (6 to 30 percent slopes) (EGE).—This mapping unit is in broken areas near the crest of mountains at the head of Hyrum Dry Canyon. Slopes are dominantly 10 to 20 percent. The rock formations are tilted, and the rocky ridges are long and narrow. These ridges are generally oriented in a north-south direction. About 55 percent of the association is Elwood silt loam, 10 to 30 percent slopes; 35 percent is Agassiz rocky silt loam, 6 to 30 percent slopes; and 10 percent is included soils.

The Elwood soil is in pockets and somewhat concave areas between rocky ridges. The depth to limestone bedrock is 28 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

The Agassiz soil is on the southern and southwestern exposures of ridges. The vegetation is big sagebrush and some curlleaf mountain-mahogany.

Included in mapping were areas of Goring silt loam, 6 to 8 percent slopes, and Obray silty clay loam, 6 to 20 percent slopes. The Goring soil is on southwestern exposures and has a cover of big sagebrush and snowberry. The Goring soil makes up about 8 percent of the mapping unit and Obray soil 2 percent.

The soils of this mapping unit are used for range, woodland, watershed, and wildlife habitat. (Elwood soil is in capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Elwood-Mult association, hilly (6 to 30 percent slopes) (EME).—This mapping unit consists of moderately steep soils on mountains east of the Logan River, near Beaver Mountain in the Franklin Basin area. The underlying rock formations are limestone and a small amount of interbedded quartzite. About 70 percent of the association is Elwood silt loam, 10 to 30 percent slopes; 20 percent is Mult silt loam, 6 to 30 percent slopes; and 10 percent is included soils.

The Elwood soil has slopes that mainly face north and east, where the vegetation is Douglas-fir and alpine fir. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Depth to limestone bedrock ranges from 28 to 40 inches.

The Mult soil has slopes that mainly face south and west. Here, the vegetation is aspen.

Included in mapping were areas of Agassiz rocky silt loam, 6 to 30 percent slopes. This soil has dominantly southern and western exposures, and vegetation on the ridges is big sagebrush.

Soils of this mapping unit are used for watershed, range, woodland, and wildlife habitat. (Elwood soil is in capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4. Mult soil is in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Elwood-Mult association, steep (30 to 60 percent slopes) (EMG).—This mapping unit lies both east and west of the Logan River in the Franklin Basin and Beaver Mountain area. The soils have all exposures in the mountains. About 70 percent of the association is Elwood silt loam, 30 to 60 percent slopes; 20 percent is Mult silt loam, 30 to 50 percent slopes; and about 10 percent is included soils.

The Elwood soil has slopes that face north and east, and the vegetation on it is conifers. The Mult soil is in concave areas or small basins, and the vegetation on it is aspen.

Included in mapping were small areas of Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and Bradshaw silt loam, 30 to 60 percent slopes. The Agassiz soil is on the ridges, where the vegetation is mostly big sagebrush and low sagebrush. The Bradshaw soil is in basins under snowberry and ceanothus.

The soils of this mapping unit are used for watershed, range, woodland, and wildlife habitat. (Elwood soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4. Mult soil is in capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2r1; wildlife suitability group 4)

Elzinga Series

The Elzinga series consists of well-drained soils that formed in residuum and colluvium derived from sandstone and limestone. These soils are on dominantly north- and east-facing mountains at elevations of 5,000 to 7,500 feet. Slopes range from 10 to 60 percent. The vegetation is maple and scattered aspen and an understory of mountain brome, slender wheatgrass, and forbs. The average annual precipitation is 20 to 25 inches, the mean annual temperature is 42° to 45° F., and the frost-free season is 90 to 110 days. Elzinga soils are associated with Maughan, Datwyler, Sheep Creek, and Agassiz soils.

In a representative profile, the surface layer is very dark gray, slightly acid silt loam about 22 inches thick. The subsurface layer is brown to pale-brown, slightly acid silt loam and cobbly silt loam about 26 inches thick. The next layer is pale-brown to dark-brown, slightly acid very cobbly very fine sandy loam to a depth of 60 inches or more.

Elzinga soils are used for watershed, range, and wildlife habitat.

Representative profile of Elzinga silt loam, 30 to 60 percent slopes, in an area of Datwyler-Elzinga-Maughan association, 3 miles south of Wellsville, 1,200 feet south and 2,000 feet east of the northwest corner of sec. 27, T. 10 N., R. 1 W.:

O1—1 inch to 0, partially decomposed leaves and twigs.

A1—0 to 22 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine, medium, and large roots; slightly acid; gradual, smooth boundary.

A21—22 to 26 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many fine and medium interstitial pores; slightly acid; clear, smooth boundary.

A22—26 to 48 inches, pale-brown (10YR 6/3) cobbly silt loam, brown to dark brown (10YR 4/3) when moist; massive; slightly hard, friable, sticky and slightly plastic; many fine and medium roots; many fine and medium interstitial pores; 30 percent cobblestones and gravel; slightly acid; gradual, smooth boundary.

A2&B2t—48 to 62 inches, about 70 percent A2 horizon and 39 percent B2t horizon. The A2 part is pale-brown (10YR 6/3) very cobbly very fine sandy loam, brown to dark brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic. The B2t part is brown (7.5YR 5/4) very cobbly clay loam, dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; many fine and medium roots; many fine and medium interstitial pores; thin continuous clay films; 60 percent cobblestones and gravel; slightly acid; gradual, wavy boundary.

R—62 inches, fractured sandstone; material from B2t horizon extends in cracks; more than 90 percent sandstone rock.

The O1 horizon ranges from ½ inch to 2 inches in thickness. The combined thickness of the A1, A2, and B2t horizons is more than 60 inches. Coarse fragments are mostly cobblestones and gravel-size, angular sandstone rock fragments; their content ranges from 30 to 50 percent in the upper A2 horizon and 50 to 60 percent in the lower A2 and B2t horizons. The A1 horizon ranges from very dark gray to very dark grayish brown in a hue of 10YR. This horizon is dominantly silt loam but ranges to loam and is as much as 15 percent gravel. Reaction is slightly acid to medium acid. Thickness ranges from 20 to 26 inches. The A2 horizon has a hue of 10YR or 7.5YR. Texture ranges from silt loam or cobbly silt loam to cobbly very fine sandy loam. Reaction is slightly acid to medium acid. The A2 horizon tongues into the B2t horizon. The B2t horizon ranges from brown to light brown. It ranges from very cobbly clay loam to very cobbly loam and is 50 to 60 percent cobblestones and gravel. Reaction is slightly acid to medium acid.

Permeability of the Elzinga soils is moderate to moderately rapid. Runoff is rapid or very rapid, and the hazard of erosion is high or very high. These soils hold from 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet or more.

In this survey area, Elzinga soils are not mapped separately but are mapped only in associations with Datwyler, Maughan, and Hoskin soils.

Fitzgerald Series

The Fitzgerald series consists of well-drained soils that formed in residuum, colluvium, and glacial till materials derived from quartzite and some limestone. These soils are in dominantly north-facing mountain areas at elevations of 7,300 to 8,500 feet. Slopes range from 10 to 20 percent. The vegetation is Douglas-fir, alpine fir, and Engelmann spruce and an understory of shrubs and grasses. The average annual precipitation is 25 to 35 inches, the mean annual air temperature is 34° to 40° F., and the mean soil temperature in summer is less than 60°. The frost-free season is 70 to 80 days. Fitzgerald soils are associated with Lucky Star, Scout, and Elwood soils.

In a representative profile, the surface layer is brown, strongly acid extremely stony loam about 8 inches thick. The subsurface layer is brown, strongly acid gravelly loam about 17 inches thick. The subsoil is pale-brown, strongly acid very gravelly sandy clay loam about 12 inches thick. The substratum, to a depth of 60 inches or more, is light brownish-gray, medium acid very gravelly fine sandy loam.

Fitzgerald soils are used for watershed, woodland, range, and wildlife habitat.

Fitzgerald extremely stony loam, 10 to 20 percent slopes (FGD).—This soil is on mountain foot slopes in the Franklin Basin area.

Representative profile, one-fourth mile north of Crescent Lake, 1,280 feet north of the southeast corner of sec. 5, T. 14 N., R. 3 E.:

O1—1 inch to 0, needles and twigs.

A1—0 to 8 inches, brown (10YR 4/3) extremely stony loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; common fine and medium roots and few large roots; 10 percent cobblestones and gravel and 5 percent stones; strongly acid; clear, wavy boundary.

A2—8 to 18 inches, brown (10YR 5/3) gravelly light loam, dark brown to brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure that parts to moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and few large roots; 20 percent cobblestones and gravel and 5 percent stones; strongly acid; gradual, wavy boundary.

A2&B2t—18 to 25 inches, 60 percent is similar to the A2 horizon, except that it is more cobbly, and 40 percent is the same as the B2t horizon.

B2t—25 to 37 inches, pale-brown (10YR 6/3) very gravelly sandy clay loam, brown (10YR 5/3) when moist; weak, medium and fine, subangular blocky structure; hard, firm, slightly sticky and plastic; common thin clay films on peds and in pores; 65 percent cobblestones and gravel and 5 percent stones; strongly acid; gradual, wavy boundary.

IIC1—37 to 60 inches, light brownish-gray (10YR 6/2) very gravelly fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; 70 percent gravel and cobblestones and a few stones; medium acid.

The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Reaction is medium acid to strongly acid. Thickness ranges from 6 to 9 inches. Stone content ranges from 5 to 15 percent. The A2 horizon ranges from brown to pale brown or very pale brown in a hue of 10YR or 7.5YR. Texture ranges from gravelly sandy loam or gravelly light loam to extremely stony sandy loam or very cobbly sandy loam. The A2 horizon is 20 to 70 percent gravel and cobblestones and is as much as 5 percent stones in places. Thickness ranges from 9 to 16 inches. The B2t horizon ranges from pale brown to brown in a hue of 10YR or 7.5YR. Texture ranges from very gravelly sandy clay loam to extremely stony sandy clay loam or very gravelly heavy loam. The B2t horizon is 50 to 70 percent cobblestones and gravel and is as much as 5 percent stones in places.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. This soil holds 5 to 7.5 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were areas of Goring silt loam, 6 to 30 percent slopes. This included soil makes up about 2 percent of the total acreage.

This Fitzgerald soil is used for range, woodland, watershed, and wildlife habitat. (Capability unit VIIs–HXC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4x1; wildlife suitability group 4)

Flygare Series

The Flygare series consists of well-drained soils that formed in alluvium and colluvium derived from quartzite sandstone and limestone. These soils are alluvial fans, old flood plains, and moraines at elevations of 6,300 to 8,000 feet. Slopes range from 3 to 20 percent. The vegetation is aspen and an understory of slender wheatgrass, Sandberg bluegrass, mulesear dock, big sagebrush, elderberry, and chokecherry. The average annual precipitation is 25 to 30 inches, the mean annual air temperature is 36° to 40° F., and the mean soil temperature in summer is less than 60°. The frost-free season is 70 to 90 days. Flygare soils are associated with Lucky Star, Goring, and Yeates Hollow soils.

In a representative profile, the surface layer is dark grayish-brown and grayish-brown, slightly acid silt loam and cobbly silt loam about 27 inches thick. The subsurface layer is light yellowish-brown, medium acid very cobbly very fine sandy loam about 12 inches thick. The subsoil is light yellowish-brown, medium acid cobbly sandy clay loam about 8 inches thick. The substratum, to a depth of 60 inches or more, is pale-brown, slightly acid very cobbly heavy sandy loam.

Flygare soils are used for range, watershed, and wildlife habitat.

Flygare silt loam, 3 to 20 percent slopes (FLD).—This soil is on slightly convex, old flood plains and alluvial fans near the Logan River in the Franklin Basin area.

Representative profile, 720 feet west and 1,360 feet north of the southeast corner of sec. 23, T. 14 N., R. 3 E.:

A11—0 to 13 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots, common medium roots; and few large roots; slightly acid; clear, smooth boundary.

A12—13 to 27 inches, grayish-brown (10YR 5/2) cobbly silt loam, dark brown (10YR 3/3) when moist; weak, coarse, subangular blocky structure that parts to moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots, common medium roots, and few large roots; 30 percent cobblestones and stones; slightly acid; abrupt, irregular boundary.

A2—27 to 39 inches, light yellowish-brown (10YR 6/4) very cobbly very fine sandy loam, brown (7.5YR 4/3) when moist; weak, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine and medium roots; 40 percent cobblestones and about 5 percent stones; medium acid; clear, irregular boundary.

B2t—39 to 47 inches, light yellowish-brown (10YR 6/4) cobbly sandy clay loam, brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few fine and medium roots; common thin clay films; about 40 percent cobblestones and 2 to 3 percent stones; medium acid; clear, wavy boundary.

C1—47 to 65 inches, pale-brown (10YR 6/3) very cobbly heavy sandy loam, brown (7.5YR 4/4) when moist; massive; slightly hard, loose, very friable, slightly sticky and nonplastic; few fine and medium roots; 60 percent cobblestone and gravel; slightly acid.

The A1 horizon ranges from dark grayish brown or grayish brown to brown in a hue of 10YR or 7.5YR. Texture is loam to silt loam or cobbly silt loam. Reaction is strongly acid to slightly acid. Thickness ranges from 21 to 30 inches. The A2 horizon ranges from light yellowish brown or brown to pale brown in a hue of 10YR or 7.5YR. Texture ranges from cobbly light loam to very cobbly sandy loam. Reaction is slightly acid to medium acid. Thickness ranges from 9 to 12 inches. A mixed A2 and B2t horizon is present in places where the A2 horizon extends into the B2t horizon. The B2t horizon ranges from light yellowish brown to brown or pale brown in hues of 10YR and 7.5YR. Texture range from cobbly sandy clay loam to gravelly clay loam. The C horizon ranges from pale brown to yellowish brown or brown in hues of 10YR and 7.5YR. Texture ranges from very cobbly sandy loam to very cobbly light loam.

Permeability is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 6 to 8 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of an extremely stony soil.

This Flygare soil is used entirely for range, watershed, and wildlife habitat. (Capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Foxol Series

The Foxol series consists of somewhat excessively drained soils that formed in residuum and colluvium derived from quartzite. These steep and very steep soils are on mountains at elevations of 6,500 to 7,500 feet. Slopes range from 30 to 60 percent. The vegetation is dominantly bluebunch wheatgrass, native bluegrass, low sagebrush, buckwheat, serviceberry, bitterbrush, yarrow, and scattered chokecherry. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 38° to 41° F., and the frost-free season is 80 to 90 days. Foxol soils are associated with Yeates Hollow, Lucky Star, Agassiz, and Hoskin soils.

In a representative profile, the soil is brown and light-brown, slightly acid and medium acid gravelly loam, very gravelly loam, and very gravelly sandy loam about 17 inches thick. Bedrock is at a depth of about 17 inches.

Foxol soils are used for range, watershed, and wildlife habitat.

Foxol rocky loam, 30 to 60 percent slopes (FOG).—This steep to very steep soil is on mountains near Scare Canyon, at the head of the Little Bear River drainage above Mineral Point.

Representative profile one-fourth mile east of old mine at Mineral Point, about 1,600 feet south of the northwest corner of sec. 30, T. 9 N., R. 3 E. (profile described between rock outcrops):

A1—0 to 7 inches, brown (7.5YR 5/3) gravelly loam, dark reddish brown (5YR 3/3) when moist; moderate, fine, granular structure; soft, friable, nonsticky and nonplastic; many fine, medium, and large roots; 30 percent gravel and cobblestones; slightly acid; clear, wavy boundary.

B2—7 to 11 inches, brown (7.5YR 5/4) very gravelly loam, reddish brown (5YR 4/3) when moist; moderate, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine and medium roots; many fine pores; 60 percent gravel and cobblestones; slightly acid; abrupt, wavy boundary.

C—11 to 17 inches, light-brown (7.5YR 6/4) very gravelly sandy loam, brown to dark brown (7.5YR 4/4) when moist; massive; loose, nonsticky and nonplastic; few fine and medium roots; many fine and medium pores; 70 percent gravel and cobblestones; medium acid; abrupt, irregular boundary.

R—17 inches, fractured, weathering quartzite rock.

The A1 horizon ranges from brown to reddish brown in hues of 7.5YR and 5YR. Thickness ranges from 7 to 12 inches. The B2 horizon ranges from brown to light reddish brown in a hue of 7.5YR or 5YR. Texture ranges from very gravelly loam to very gravelly heavy sandy loam. Structure is weak to moderate, fine to coarse, subangular blocky. Reaction is slightly acid to medium acid. Thickness ranges from 4 to 11 inches. The C horizon ranges from light brown to pink in a hue of 7.5YR or 5YR. Texture ranges from very gravelly loam to very gravelly sandy loam. Reaction is slightly acid to medium acid. The coarse fragments are mainly cobblestones and gravel-size angular quartzite fragments. These fragments make up 20 to 50 percent of the A horizon and 50 and 80 percent of the B2 and C horizons.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 2 to 3.5 inches of available water above the bedrock. Roots are mostly in the surface layer, 14 to 20 inches above the quartzite bedrock, but some roots extend into cracks in the rocks.

Included in mapping were areas of Yeates Hollow extremely stony silt loam, 30 to 70 percent slopes, and areas of rock outcrop. The Yeates Hollow soil makes up about 2 percent of the total acreage, and the rock outcrop 5 to 8 percent.

This Foxol soil is used for range, watershed, and wildlife habitat. (Capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Goring Series

The Goring series consists of well-drained soils that formed in colluvium and residuum derived from sandstone, quartzite, and small amounts of limestone. These soils are on mountains at elevations of 5,300 to 7,200 feet. Slopes range from 3 to 60 percent. The vegetation is bluebunch wheatgrass, tall native bluegrass, Great Basin wildrye, prairie junegrass, Columbia needlegrass, yarrow, lupine, yellowbrush, bitterbrush, and big sagebrush. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 38° to 42° F., and the frost-free season is 80 to 100 days. Goring soils are associated with Agassiz, Yeates Hollow, Obray, Curtis Creek, Hoskin, Scave, and Lucky Star soils.

In a representative profile, the surface layer is brown, slightly acid silt loam about 7 inches thick. The upper part of the subsoil is brown and reddish-brown, slightly acid silty clay about 28 inches thick. The lower part of the subsoil is red, slightly acid silty clay loam to a depth of 60 inches or more.

Goring soils are used for range, watershed, and wildlife habitat. Some small areas formerly were cultivated, but are now seeded to grasses. These soils are not suited to cultivated crops, because of the frost hazard.

Goring silt loam, 6 to 30 percent slopes (GGE).—This soil is in the mountains, mainly in the Hardware Ranch-Ant Flat area. Some of the acreage is in the Logan River and Little Bear River drainage areas.

Representative profile, about 2½ miles northeast of Hardware Ranch headquarters, about 1,000 feet south and 1,400 feet west of the northeast corner of sec. 7, T. 10 N., R. 4 E.:

A11—0 to 3 inches, brown (10YR 4/3) silt loam, dark brown (10YR 3/3) when moist; weak, thick, platy structure; soft, friable, slightly sticky and slightly plastic; many fine roots; slightly acid; abrupt, wavy boundary.

A12—3 to 7 inches, brown (10YR 4/3) silt loam, dark brown (10YR 3/3) when moist; moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; slightly acid; clear, wavy boundary.

B1—7 to 13 inches, brown (7.5YR 4/3) light silty clay loam, dark brown (7.5YR 3/3) when moist; moderate, medium and fine, angular blocky structure; hard, firm, friable, sticky and plastic; many fine roots; common, fine, discontinuous, interstitial pores; slightly acid; clear, wavy boundary.

B21t—13 to 22 inches, reddish-brown (5YR 4/3) heavy silty clay loam, dark reddish brown (5YR 3/3) when moist; moderate, coarse, prismatic structure that parts to fine and medium, angular blocky structure; very hard, firm, sticky and plastic; common fine roots; common, fine, discontinuous, interstitial pores; moderately thick continuous clay films; slightly acid; diffused, wavy boundary.

B22t—22 to 35 inches, reddish-brown (5YR 4/4) silty clay, yellowish red (5YR 4/6) when moist; strong, coarse, subangular blocky structure that parts to medium and fine, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; common, fine, discontinuous, interstitial pores; moderately thick continuous clay films; slightly acid; diffused, wavy boundary.

B23t—35 to 60 inches, red (2.5YR 4/6) heavy silty clay loam, dark red (2.5YR 2/6) when moist; moderate, coarse, subangular blocky structure that parts to fine and medium, subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; common, fine, discontinuous pores; moderately thick continuous clay films; slightly acid.

The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Texture ranges from silt loam to clay loam. Reaction is slightly acid to neutral. Thickness ranges from 7 to 14 inches. The B1 horizon ranges from brown to reddish brown in a hue of 5YR, 7.5YR, or 10YR. Texture ranges from silt loam to light silty clay loam. The B1 horizon is 10 to 20 percent gravel and cobblestones in places. Reaction is slightly acid to neutral. Thickness ranges from 3 to 11 inches. The B2t horizon ranges from reddish brown to strong brown or red in a hue of 7.5YR, 5YR, or 2.5YR. Texture ranges from clay or silty clay to heavy silty clay loam.

The soil is fairly easy to till. Permeability is slow. Runoff is slow to moderate, and the hazard of erosion is slight to moderate. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more, but most roots are above the silty clay horizon.

Included in mapping were small areas of Ant Flat loam, 6 to 20 percent slopes; Obray silty clay, 6 to 20 percent slopes; Curtis Creek loam, 10 to 30 percent slopes; and Yeates Hollow extremely stony silt loam, 6 to 30 percent slopes. These inclusions together make up about 8 percent of the mapping unit.

This Goring soil generally is used for range, watershed, and wildlife habitat. Some areas formerly were cultivated but now are mostly reseeded to grasses. Cultivated crops are severely limited because of the frequent frosts late in spring or early in summer. Small grain and alfalfa are grown. None of the acreage is irrigated. (Capability unit VIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Goring-Obray association, eroded (3 to 30 percent slopes) (GoE2).—This mapping unit is west of the Little Bear River, between McMurdie Hollow and Three-Mile Canyon, and also in the Ant Flat and Bear Flat areas south of Hardware Ranch. These gently sloping to steep soils are on broad, gently rolling mountain ridges and eroded old alluvial fans or terraces. About 45 percent of the association is Goring clay loam, 3 to 30 percent slopes, eroded; 25 percent is Obray silty clay, 6 to 20 percent slopes, eroded; 25 percent is Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded; and 5 percent is included soils.

The Goring soil is similar to Goring silt loam, 6 to 30 percent slopes, except that it is moderately eroded and its surface layer is clay loam only 6 to 10 inches thick. Also, the horizon of clay accumulation is at a depth of only 8 to 15 inches. Runoff is medium, and the hazard of erosion is moderate. The vegetation is low sagebrush, mulesear dock, slender wheatgrass, and western wheatgrass.

Included in mapping were areas of Sheep Creek cobbly loam, 30 to 70 percent slopes.

Soils of this association are essentially all used for range, watershed, and wildlife habitat. (Goring soil is in capability unit VIe–M5, nonirrigated; Mountain Clay range site. Obray soil is in capability unit VIe–M5, nonirrigated; Mountain Clay range site. Yeates Hollow soil is in capability unit VIIs–MX5, nonirrigated; Mountain Stony Clay range site. None of the soils is in a woodland suitability group; all soils are in wildlife suitability group 3)

Gravel Pit

Gravel pit (Gp) is a miscellaneous land type that consists of open excavations from which sand and gravel have been removed. Most of the material has been used in building construction and for road subgrade and surfacing. An area near the Hyrum and Newton dams was used as earthfill during their construction. Most of these pits are still in operation and have no farming value. (Capability unit VIIIs–4, nonirrigated; not in a range site, woodland suitability group, or wildlife suitability group)

Green Canyon Series

The Green Canyon series consists of somewhat excessively drained soils that formed in very strongly calcareous alluvium derived from dolomitic limestone. These soils are on alluvial fans deposited on intermediate and high lake terraces at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 7 percent. The vegetation is big sagebrush, gumweed, bluebunch wheatgrass, native bluegrass, and cheatgrass. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 130 to 150 days. Green Canyon soils are associated with Millville, Steed, Sterling, and Ricks soils.

In a representative profile, the surface layer is dark grayish-brown to brown, moderately alkaline gravelly loam about 16 inches thick. The next layer is brown, moderately alkaline, very strongly calcareous very gravelly fine sandy loam about 7 inches thick. This is underlain by light brownish-gray, moderately alkaline, very strongly calcareous very gravelly loamy sand that extends to a depth of 60 inches or more.

Green Canyon soils are used mostly for irrigated cropland. Alfalfa, small grain, and improved pasture are the principal crops.

Green Canyon gravelly loam, 3 to 7 percent slopes (GrB).—This soil is on the upper part of alluvial fans formed at the mouth of Green Canyon east of North Logan. The Green Canyon Forest Nursery is located on this soil. The topography is slightly undulating.

Representative profile, 550 feet east of Green Canyon Forest Nursery shed, 500 feet north and 500 feet west of the center of sec. 24, T. 12 N., R. 1 E.:

A11—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; 20 percent gravel; strongly calcareous; moderately alkaline; gradual, smooth boundary.

A12—9 to 16 inches, brown to dark-brown (7.5YR 4/2) gravelly loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; 20 percent gravel; strongly calcareous; moderately alkaline; clear, smooth boundary.

C1—16 to 23 inches, brown (10YR 5/3) very gravelly fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable, nonsticky and nonplastic; common fine roots; common fine pores; 50 percent gravel; very strongly calcareous; moderately alkaline; clear, wavy boundary.

IIC2—23 to 60 inches, light brownish-gray (10YR 6/2) very gravelly loamy sand, grayish brown (10YR 5/2) when moist; massive; loose, nonsticky and nonplastic; few fine roots; 70 percent gravel; very strongly calcareous; moderately alkaline.

The A1 horizon is strongly calcareous to very strongly calcareous. Thickness ranges from 11 to 18 inches. The C horizon ranges from brown to light brownish gray or to brown in a hue of 10YR or 7.5YR. Texture ranges from very gravelly fine sandy loam or gravelly fine sandy loam to very gravelly loamy sand. Reaction is moderately alkaline to strongly alkaline. Gravel content ranges from 15 to 35 percent in the surface layer, from 30 to 50 percent in the subsoil, and from 50 to 80 percent in the substratum. In some areas the soil contains some cobblestones on the surface and throughout the profile.

The soil is fairly easy to till, but the gravel causes excessive wear on tillage implements. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. This soil holds 3.0 to 3.75 inches of available water to a depth of 5 feet. The organic-matter content of the surface layer ranges from 1 to 3.5 percent, and natural fertility is moderate. Roots are mostly in the surface layer above the very gravelly material, but some roots penetrate the very gravelly material.

Included in mapping were small areas of Millville silt loam, 2 to 4 percent slopes.

This Green Canyon soil is used for irrigated crops of alfalfa, small grain, and pasture. Where irrigation water is not available, the soil is used for dryland crops of alfalfa and winter wheat. A few acres are used for grazing. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Green Canyon gravelly loam, 0 to 3 percent slopes (GrA).—This soil occurs with Green Canyon gravelly loam, 3 to 7 percent slopes. Except for slope, it is similar to that soil. It is on the lower part of fans. Runoff is slow, and the hazard of erosion is slight.

Included in mapping were small areas of Millville silt loam, 2 to 4 percent slopes.

This Green Canyon soil is used mainly for irrigated crops of alfalfa, small grain, and pasture. A small acreage is in apple orchards. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Greenson Series

The Greenson series consists of somewhat poorly drained and moderately well drained soils that formed in mixed lake sediment and alluvium derived dominantly from limestone, sandstone, and quartzite. These nearly level to strongly sloping soils are on low lake terraces and fans at elevations of 4,450 to 4,650 feet. Slopes range from 0 to 10 percent. The vegetation is saltgrass, foxtail, alkali sacaton, Kentucky bluegrass, and some sedges and wiregrass. Average annual precipitation is 14 to 17 inches, and mean annual air temperature is 45° to 48° F. The frost-free season is 120 to 140 days. Greenson soils are associated with Collett, Nibley, Logan, Lewiston, and Roshe Springs soils.

In a representative profile (fig. 4), the surface layer is gray, mildly alkaline loam about 16 inches thick. The

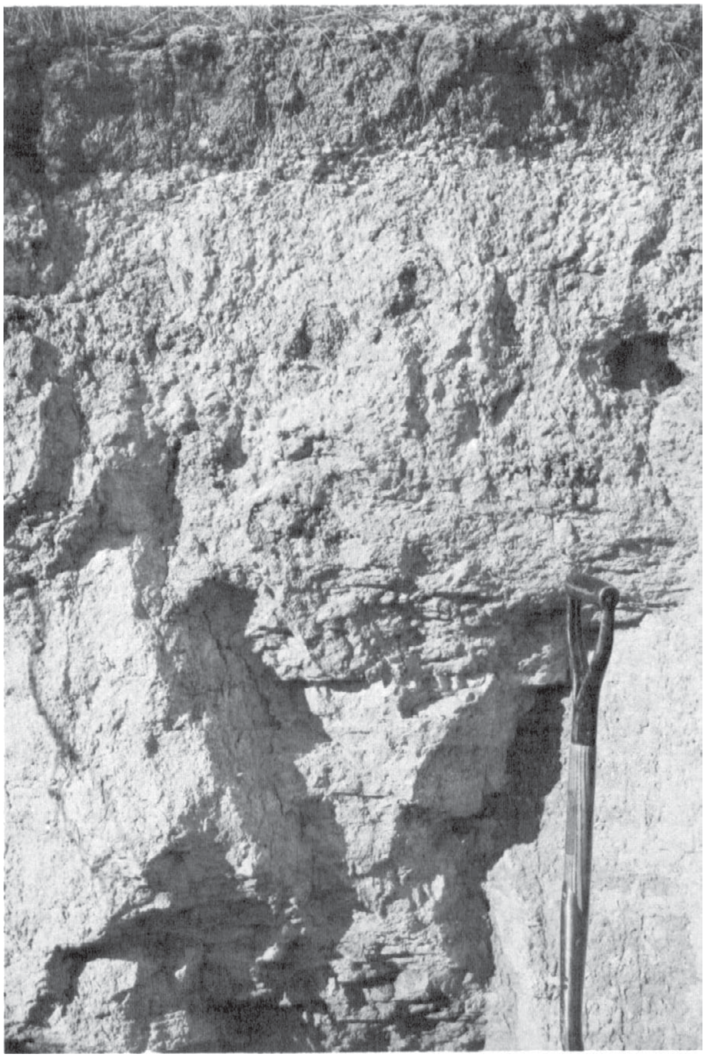

Figure 4.—Profile of Greenson loam, 0 to 3 percent slopes, showing the light-colored layer of lime accumulation that is near the surface of this soil.

subsoil is light brownish-gray, moderately alkaline loam about 7 inches thick. The substratum to a depth of 60 inches or more, is light-gray or very pale brown loam. Some carbonates have been leached from the surface layer and subsoil and redeposited in the substratum.

Greenson soils are used dominantly for irrigated crops of alfalfa, small grain, corn, sugar beets, and improved pasture. Some areas are used for range, and some are used for community and industrial development.

Greenson loam, 0 to 3 percent slopes (GsA).—This soil is on broad, smooth or slightly undulating, low lake terraces.

Representative profile in an irrigated area, 1 mile east and ¼ mile north of Wellsville Cemetery, 1,320 feet south and 600 feet east of the northeast corner of sec. 36, T. 11 N., R. 1 W.:

Ap—0 to 7 inches, gray (10YR 5/2) loam, very dark gray (10YR 3/1) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common medium pores; slightly calcareous; mildly alkaline; clear, smooth boundary.

A1—7 to 16 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; moderate, medium, granular structure that parts to moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common medium pores; slightly calcareous; mildly alkaline; clear, wavy boundary.

B2—16 to 23 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few medium pores; slightly calcareous, moderately alkaline; clear, wavy boundary.

C1ca—23 to 39 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; few, fine, faint, yellowish-brown (10YR 5/8) moist mottles; weak, very fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—39 to 51 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/6), moist mottles; massive; hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline; clear, wavy boundary.

C3—51 to 72 inches, very pale brown (10YR 8/3) loam, pale brown (10YR 6/3) when moist; common, medium, distinct, strong-brown (7.5YR 5/6), moist mottles; massive; hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline.

The A horizon ranges from gray to dark gray or dark grayish brown. Its texture is loam to silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is slightly calcareous. Thickness ranges from 12 to 19 inches. The B2 horizon ranges from light brownish gray to light gray or grayish brown in a hue of 10YR or 2.5Y. Texture is loam or silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is slightly calcareous to moderately calcareous. Thickness ranges from 4 to 13 inches. The C horizon ranges from light gray to white or pale olive in hues of 10YR or 5Y. Texture ranges generally from loam to silt loam or silty clay loam, but is gravelly loam in places. A horizon of lime accumulation occurs at a depth of 16 to 24 inches and is weakly cemented in places. Reaction is moderately alkaline to strongly alkaline. Faint to distinct, yellowish-brown or strong-brown mottles are at depths between 20 and 38 inches.

This soil is easy to till. Permeability is moderate. Runoff is slow, and the erosion hazard is none to slight. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Depth to the water table ranges from 30 to 60 inches. Much of the acreage is artificially drained. Roots extend to a depth of 5 feet where the soils are drained. In the undrained areas, most roots are above the water table.

Included in mapping were small areas of Collett silty clay loam and Logan silty clay loam.

This Greenson soil is used for irrigated crops of alfalfa, small grain, sugar beets, and pasture. (Capability unit IIw–2, irrigated; not in a range site or woodland suitability group; wildlife suitability group 1)

Greenson loam, 3 to 6 percent slopes (GsB).—This soil is similar to Greenson loam, 0 to 3 percent slopes, except that it is more sloping and its surface layer is 8 to 16 inches thick. This moderately well drained, moderately sloping soil generally is in small areas on terrace breaks. In a few places, the substratum is gravelly below a depth of 36 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Collett silty clay loam and small areas of Greenson loam, 6 to 10 percent slopes.

This soil is used mainly for irrigated crops of alfalfa, small grain, and improved pasture. A few small areas are used for native meadow pasture. (Capability unit IIw–2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Greenson loam, 6 to 10 percent slopes (GsC).—This soil commonly is in long, narrow bands on terrace breaks. It is similar to Greenson loam, 0 to 3 percent slopes, except that it is more strongly sloping and its surface layer is 8 to 12 inches thick. Wetness generally results from seeps along the upper areas of this soil. Surface runoff is medium, and the hazard of erosion is moderate.

Included in mapping were a few small areas of Nibley silty clay loam, 3 to 6 percent slopes, and a few small areas of soils that have a gravelly substratum.

This soil is used mostly for irrigated crops of alfalfa, small grain, and pasture. Some areas are used for native meadow pasture. (Capability unit IIIe–2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Greenson loam, deep over gravel, 0 to 1 percent slopes (GvA).—This soil is similar to Greenson silt loam, 0 to 3 percent slopes, except that the substratum is gravelly. Depth to gravelly loam material is below 36 inches. In places small amounts of gravel are scattered on the surface and throughout the profile. In an area of this soil south of the old Logan Sugar Factory, the gravel is strongly cemented at a depth below 3 feet. This makes drainage difficult and more costly. Runoff is slow, and the hazard of erosion is none to slight.

Included in mapping were small areas of Provo gravelly loam.

This Greenson soil is used mainly for irrigated crops of alfalfa, small grain, sugar beets, corn, and improved pasture. Small areas are used for native meadow hay and pasture. (Capability unit IIw–2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Greenson loam, deep over clay, 0 to 1 percent slopes (GuA).—This soil is similar to Greenson loam, 0 to 3 percent slopes, except that the substratum is silty clay or heavy silty clay loam that is slowly permeable. The soil is on low lake terraces adjacent to Collett, Logan, and Nibley soils. An area of this soil in the vicinity of the Utah State University Drainage and Reclamation Farm is moderately saline and alkali affected. This soil is somewhat poorly drained, and its permeability is slow, Runoff is slow, and the hazard of erosion is slight. Depth to the fine-textured underlying material ranges from 32 to 40 inches. The water table commonly is above the fine-textured material.

This soil is mostly used for irrigated crops of alfalfa, small grain, corn, sugar beets, and pasture. (Capability unit IIIw-25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Hendricks Series

The Hendricks series consists of well-drained soils that formed in noncalcareous alluvium derived from sandstone and quartzite. These soils are on old alluvial fans, slightly below or just above the highest lake terraces at elevations of 4,800 to 5,400 feet. Slopes range from 1 to 20 percent. The vegetation is big sagebrush, slender wheatgrass, cheatgrass, prairie junegrass, balsamroot, and yarrow. The average annual precipitation is 17 to 20 inches, the mean annual air temperature is 44° to 48° F., and the frost-free season is 120 to 140 days. Hendricks soils are associated with Nebeker, Hiibner, and Crowshaw soils.

In a representative profile, the surface layer is dark grayish-brown, neutral silt loam about 5 inches thick. The upper part of the subsoil is dark grayish-brown silt loam about 10 inches thick, and the lower part is brown to dark-brown or yellowish-brown, slightly acid silty clay loam to a depth of 60 inches or more.

Hendricks soils generally are used chiefly for dry cropland, but some areas are irrigated. Crops are small grain, alfalfa, silage corn, sugar beets, and pasture. Some small areas are used for range.

Hendricks silt loam, 6 to 10 percent slopes (HdC).—This soil is on gently undulating, old alluvial fans on or above the highest lake terraces. The soil extends along both eastern and western sides of Cache Valley.

Representative profile in a cultivated area, 1 mile south and 1¾ miles east of the old North Cache High School at Richmond, 900 feet east and 50 feet south of the northwest corner of the southeast quarter of sec. 1, T. 13 N., R. 1 E.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; very dark brown (10YR 2/2) when moist; moderate, medium, granular structure that parts to moderate, fine, granular structure; slightly hard, friable, slightly sticky and plastic; common fine roots; common fine pores; neutral; abrupt, smooth boundary.

B1—5 to 15 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 22) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine roots; common fine and medium pores and few large pores; slightly acid; clear, smooth boundary.

B21t—15 to 27 inches, brown to dark-brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many fine pores and few medium pores; thin continuous clay films; slightly acid; clear, wavy boundary.

B22t—27 to 47 inches, yellowish-brown (10YR 5/4) silty clay loam, brown to dark brown (7.5YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine pores; thin continuous clay films; slightly acid; clear, smooth boundary.

B23t—48 to 66 inches, brown (7.5YR 5/4) silty clay loam, brown to dark brown (7.5YR 4/3) when moist; weak, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine pores and few medium pores; common thin clay films; slightly acid.

The A horizon ranges from dark grayish brown to grayish brown or to very dark grayish brown in a hue of 10YR. Texture ranges from silt loam or loam to very fine sandy loam. Thickness ranges from 5 to 12 inches. Some areas have a small amount of gravel and a few cobblestones scattered on the surface and throughout the profile. The B2t horizon ranges from silty clay loam to clay loam. Reaction is neutral to slightly acid.

The soil is easy to till. Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots extend to a depth of 5 feet or more.

Included in mapping were small areas of Crowshaw gravelly loam, 6 to 10 percent slopes, and small areas of recent stony alluvium.

This soil is used mainly for dryland crops of alfalfa and small grain. Some areas are irrigated. (Capability unit IIIe-2, irrigated, IIIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Hendricks silt loam, 1 to 3 percent slopes (HdA).—This soil is on the lower part of alluvial fans. Except for slope, it is similar to Hendricks silt loam, 6 to 10 percent slopes. Runoff is slow, and the hazard of erosion is slight.

Included in mapping were small areas of Ricks gravelly loam, 0 to 3 percent slopes, and a few small areas of a soil that has slopes of 3 to 6 percent.

About 60 percent of the acreage of this Hendricks soil is irrigated. Crops are alfalfa, small grain, corn for silage, and sugar beets. Nearly 40 percent is used for dryland crops of alfalfa and small grain. A few areas are used for range. (Capability unit IIc-2, irrigated, IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Hendricks silt loam, 3 to 6 percent slopes (HdB).—This is a gently undulating soil on old alluvial fans. It is similar to Hendricks silt loam, 6 to 10 percent slopes, except that it is less sloping and its surface layer is about 7 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is easy to work, has good tilth, and can be cultivated within a wide range of moisture content.

Included in mapping were small areas of Ricks gravelly loam, 3 to 6 percent slopes.

About 70 percent of the acreage of this Hendricks soil is irrigated, and 30 percent is dryfarmed. Alfalfa and small grain are the principal crops. (Capability unit IIe-2, irrigated; IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Hendricks silt loam, 10 to 20 percent slopes (HdD).—This soil is on alluvial fans with other Hendricks soils. Except for slope, it is similar to Hendricks silt loam, 6 to 10 percent slopes. The subsoil ranges from silty clay loam to heavy silt loam in the upper part and is silty loam in the lower part. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Included in mapping were small areas of Sterling gravelly loam, 10 to 20 percent slopes, and a few small areas of a soil that has slopes of slightly more than 20 percent.

This Hendricks soil is used mostly for dryland crops of small grain and alfalfa. Some areas are used for range. (Capability unit IVe-2, irrigated, IVe-M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hiibner Series

The Hiibner series consists of well-drained soils that formed in colluvium and alluvium derived from sandstone and quartzite. These soils are on alluvial fans and on dissected slopes of mountains. The elevation ranges from 4,500 to 6,000 feet, and slopes range from 1 to 30 percent. The average annual precipitation is 17 to 20 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 100 to 140 days. Hiibner soils are associated with Nebeker, Parleys, Hendricks, and Crowshaw soils.

In a representative profile, the surface layer is very dark grayish-brown and dark grayish-brown, neutral extremely stony gravelly clay loam about 6 inches thick. The subsoil is reddish-brown, slightly acid very cobbly clay that extends to a depth of 60 inches or more.

Hiibner soils are used chiefly for range. Some small areas are used for dryland crops of alfalfa and small grain.

Hiibner extremely stony clay loam, 1 to 30 percent slopes (HfE).—This soil is on alluvial fans and mountain foot slopes, mainly near the town of Mendon and east of Paradise.

Representative profile, about 1 mile west of Mendon, 30 feet west and 20 feet north of the northeast corner of sec. 1, T. 11 N., R. 2 W.:

A11—0 to 3 inches, very dark grayish-brown (10YR 3/2) extremely stony clay loam, very dark brown (10YR 2/2) when moist; weak, fine, platy structure that parts to weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; medium fine pores; about 25 percent gravel and cobblestones and 5 percent stones; neutral; clear, wavy boundary.

A12—3 to 6 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots and few medium roots; many fine and large pores; about 25 percent gravel and cobblestones and 5 percent stones; neutral; clear, wavy boundary.

B21t—6 to 12 inches, brown to dark-brown (7.5YR 4/2) very cobbly clay, dark brown (7.5YR 3/2) when moist; strong, medium, prismatic structure that parts to moderate, fine, angular blocky structure; extremely hard, extremely firm, sticky and plastic; common medium roots; common fine and medium pores; 40 percent gravel and cobblestones and 10 percent stones; common moderately thick clay films; slightly acid; gradual, wavy boundary.

B22t—12 to 27 inches, reddish-brown (5YR 5/4) very cobbly clay, reddish brown (5YR 4/4) when moist; strong, coarse, prismatic structure that breaks to moderate, fine, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; common fine and medium roots; common fine pores; common thick clay films; 50 percent cobblestones and gravel and 10 percent stones; slightly acid; gradual, wavy boundary.

B23t—27 to 60 inches, reddish-brown (5YR 5/4) very cobbly clay, reddish brown (5YR 4/4) when moist; strong, coarse, prismatic structure that breaks to moderate, fine, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine and medium roots; few fine and medium pores; common thick clay firms; 70 percent cobblestones and gravel and 10 percent stones; slightly acid.

The A1 horizon ranges from very dark grayish brown to dark grayish brown or to brown in a hue of 10YR or 7.5YR. Texture ranges from gravelly loam to gravelly clay loam or extremely stony clay loam. Reaction is neutral to slightly acid. Thickness ranges from 5 to 12 inches. The B2t horizon ranges from reddish brown to brown or dark brown to yellowish brown in hues of 10YR to 5YR. Texture ranges from very cobbly clay to extremely stony heavy clay loam. The B2t horizon is 40 to 70 percent gravel and cobblestones and about 10 percent stones. Reaction ranges from slightly acid to mildly alkaline.

Permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 5 to 7 inches of available water to a depth of 5 feet. Roots extend to a depth of 4 feet or more.

Included in mapping were small areas of Nebeker silt loam, 10 to 25 percent slopes, and small areas of Hiibner gravelly clay loam, 20 to 30 percent slopes.

This soil is used for range that is grazed after crops are harvested from adjacent fields. (Capability unit VIIs-MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Hiibner gravelly clay loam, 3 to 10 percent slopes (HeC).—This soil is on mountain foot slopes and high terraces. It is similar to Hiibner extremely stony clay loam, 1 to 30 percent slopes, except that the surface layer is gravelly clay loam 8 to 12 inches thick and is slightly eroded. Runoff is slow to medium, and the erosion hazard is slight to moderate.

Included in mapping were small areas of a soil that has 1 to 3 percent slopes, and small areas of Nebeker silt loam, 6 to 10 percent slopes.

This Hiibner soil is used mainly for range that is grazed after the crops from adjacent cropland have been harvested. Some areas are used for dryland small grain crops. (Capability unit IIIe-MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Hiibner gravelly clay loam, 10 to 20 percent slopes (HeD).—This soil is in long, narrow tracts on mountain foot slopes and high lake terrace escarpments. It is similar to Hiibner extremely stony clay loam, 1 to 30 percent slopes, except that the surface layer is gravelly clay loam 9 to 12 inches thick and is slightly eroded. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Nebeker silt loam, 10 to 25 percent slopes, and small areas of a soil that has slightly steeper slopes.

This Hiibner soil is used for range that is grazed after the crops on adjacent cropland areas have been harvested. (Capability unit IVe-MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Hiibner gravelly clay loam, 20 to 30 percent slopes (HeE).—This soil is in long, narrow tracts on mountain foot slopes and high lake terrace escarpments. It is similar to Hiibner extremely stony clay loam, 1 to 30 percent slopes, except that the surface layer is gravelly clay loam 7 to 12 inches thick and is slightly eroded. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Included in mapping were small areas of Nebeker silt loam, 10 to 25 percent slopes, and small areas of a soil that has slightly steeper slopes.

This Hiibner soil is used for rangeland, watershed, and wildlife habitat. (Capability unit VIe–MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Hillfield Series

The Hillfield series consists of well-drained soils that formed in mixed lake sediment derived mainly from limestone, sandstone, and quartzite. These soils are on terrace escarpments and rolling terraces along the eastern side of Cache Valley. The elevation ranges from 4,800 to 5,100 feet. Slopes range from 10 to 30 percent. The vegetation is western wheatgrass, cheatgrass, bluebunch wheatgrass, yarrow, and big sagebrush. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 130 to 150 days. Hillfield soils are associated with Parleys, Timpanogos, McMurdie, and Ricks soils.

In a representative profile, the surface layer is brown, mildly alkaline silt loam about 8 inches thick. This is underlain by mildly alkaline, light yellowish-brown silt loam, very pale brown and light yellowish-brown loam, and light yellowish-brown very fine sandy loam that extends to a depth of 60 inches or more. The soil is strongly calcareous throughout. Some carbonates have leached from the upper part of the soil and redeposited, at a depth of 7 to 12 inches, to form a lime horizon.

Hillfield soils are used mostly for dryland crops of alfalfa and small grain.

Hillfield silt loam, 20 to 30 percent slopes, eroded (HgE2).—This soil is on high lake terrace escarpments along the eastern side of Cache Valley. It is rolling or hilly and has short slopes that generally face west. The soil is moderately eroded.

Representative profile in a cultivated area, 2 miles north and ½ mile east of Paradise, 400 feet south and 600 feet east of the northeast corner of the southeast quarter of sec. 15, R. 10 N., R. 1 E.:

Ap—0 to 8 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; common fine pores; strongly calcareous, mildly alkaline; abrupt, smooth boundary.

C1ca—8 to 15 inches, light yellowish-brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; common fine pores and few medium pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C2ca—15 to 23 inches, very pale brown (10YR 7/4) loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; common fine pores; strongly calcareous; mildly alkaline; clear, wavy boundary.

C3—23 to 40 inches, light yellowish-brown (10YR 6/4) loam, brown (10YR 5/3) when moist; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many fine and few medium pores; strongly calcareous; mildly alkaline.

C4—40 to 60 inches, light yellowish-brown (10YR 6/4) very fine sandy loam, brown (10YR 5/3) when moist; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; single grain; soft, very friable, nonsticky and nonplastic; strongly calcareous; mildly alkaline.

The A horizon ranges from brown to pale brown or grayish brown. Thickness ranges from 7 to 9 inches. Texture is dominantly silt loam but ranges to loam, very fine sandy loam, or light silty clay loam. The Cca and C horizons range from very pale brown to light yellowish brown or light brownish gray. These horizons are stratified and range from loamy to loamy fine sand or to silty clay loam. The calcium carbonate equivalent in the Cca horizon ranges from 20 to 40 percent. Reaction is mildly alkaline to moderately alkaline.

This soil is easy to till. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. This soil holds 8 to 10 inches of available water to a depth of 5 feet. Roots extend to a depth of 4 feet or more.

Included in mapping were small areas of Parleys silt loam, 6 to 10 percent slopes, and a few small areas of a Hillfield soil that has slopes of 10 to 20 percent.

This soil is used mostly for range but provides only limited grazing. Some of the acreage is used for dryland crops of alfalfa and small grain. (Capability unit VIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Hillfield-Timpanogos silt loams, 10 to 30 percent slopes, eroded (HhE2).—This complex consists of rolling to moderately steep soils on high lake terraces on the eastern side of Cache Valley. Runoff is medium to rapid, and the hazard of erosion is moderate to high. About 60 percent of the association is Hillfield silt loam, 20 to 30 percent slopes, eroded, and about 40 percent is Timpanogos silt loam, 10 to 20 percent slopes, eroded.

The Hillfield soil is steeper than the Timpanogos soil and has slopes that face south and west. In places its surface layer is very fine sandy loam.

The more gently sloping Timpanogos soil has a northerly exposure. It is similar to Timpanogos silt loam, 0 to 3 percent slopes, except that it is more sloping and its surface layer is 7 to 9 inches thick. The soil is moderately eroded, and in places the subsoil has been exposed by tillage.

Included in mapping were small areas of Parleys silt loam, 6 to 10 percent slopes.

The soils of this complex are used for dryfarming and interspersed areas of range. Winter wheat and alfalfa are the principal crops. (Capability unit VIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Hoskin Series

The Hoskin series consists of somewhat excessively drained soils that formed in residuum and colluvium derived from the Wasatch conglomerate and sandstone. Bedrock is at a depth of 24 to 40 inches. These soils are on dominantly south- and west-facing mountain slopes at elevations of 6,000 to 8,000 feet. Slopes range from 1 to 70 percent. The vegetation is big sagebrush, bluebunch wheatgrass, Great Basin wildrye, bitterbrush, yellowbrush, cheatgrass, serviceberry, and balsamroot. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 40° to 45° F., and the frost-free season is 70 to 90 days. Hoskin soils are associated with Ant Flat, Scave, Lucky Star, Agassiz, and Scout soils.

In a representative profile, the surface soil is brown to dark-brown, neutral cobbly loam about 7 inches thick. The subsoil is brown, neutral very cobbly loam about 9 inches thick. The substratum is brown, neutral very cobbly loam about 12 inches thick. Bedrock is at a depth of about 28 inches. Between the depths of 7 and 20 inches, the soil is continuously dry for a period of 50 days or more in summer.

Hoskin soils are used for range, wildlife habitat, and watershed.

Hoskin cobbly loam, 30 to 70 percent slopes, eroded (HKG2).—This soil is on west- and south-facing slopes of mountains. It is mostly in the area south of Hardware Ranch near the Sheep Creek and Mill Creek drainages. Small areas are in the Cinnamon Creek area south of Mineral Point. Other areas are scattered throughout the mountains.

Representative profile, 100 feet west and 100 feet south of the northeast corner of sec. 21, T. 9 N., R. 3 E., 6½ miles south and 1 mile west of Hardware Ranch:

A1—0 to 7 inches, brown to dark-brown (7.5YR 4/3) cobbly loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine, medium, and large roots; 40 percent gravel and cobblestones; neutral; clear, wavy boundary.

B2t—7 to 16 inches, brown (7.5YR 5/4) very cobbly loam, dark brown (7.5YR 3/4) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many fine and medium roots; many fine pores; common thin clay films; 60 percent gravel and cobblestones; neutral; gradual, wavy boundary.

C—16 to 28 inches, brown (7.5YR 5/4) very cobbly loam; brown to reddish brown (5YR 4/4) when moist; massive; soft, friable, nonsticky and slightly plastic; few fine and medium roots; many fine pores; soil matrix is noncalcareous, lime on underside of coarse fragments; 80 percent cobblestones and stones; neutral.

R—28 inches, consolidated conglomerate.

The combined thickness of the A1, B1, and B2t horizons ranges from 14 to 30 inches. Coarse fragments are mainly cobblestones and gravel-size, rounded or slightly angular fragments of quartzite or sandstone. Their content ranges from 20 to 50 percent in the A1 and B1 horizons and from 50 to 80 percent in the B2t and C horizons. The A1 horizon ranges from brown to dark brown or reddish brown in a hue of 7.5YR or 5YR. Reaction is neutral to slightly acid. Thickness ranges from 5 to 12 inches. In the Cinnamon Creek area, this soil is only slightly eroded and the surface layer ranges from 12 to 15 inches in thickness. The B2t horizon ranges from brown to reddish brown or strong brown in a hue of 7.5YR or 5YR. Texture ranges from very cobbly sandy clay loam to very cobbly loam. Reaction ranges from neutral to medium acid. Thickness ranges from 8 to 15 inches. The C horizon ranges from brown or reddish brown to yellowish brown or light reddish brown in a hue of 7.5 YR, 5YR, or 10YR. Texture ranges from very cobbly loam or stony loam to very cobbly sandy loam. Reaction is neutral to mildly alkaline.

Permeability is moderately rapid. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 3.5 to 4.0 inches of available water above the bedrock. Roots penetrate to the bedrock.

Included in mapping were small areas of Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded.

This Hoskin soil is used for range, wildlife habitat, and watershed. (Capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hoskin-Datwyler association, eroded (30 to 70 percent slopes) (HLG2).—This mapping unit consists of soils on Murrays Hill at the south end of the Wellsville Mountain. These soils generally are on the broad ridges and upper side slopes adjacent to the ridges, which have south and east aspects. They are at elevations of 5,500 to 6,500 feet. About 50 percent of the association is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 30 percent Datwyler cobbly silty clay loam, 30 to 60 percent slopes; and 20 percent included soils.

The Hoskin soil is dominant on the landscape and is intermingled with outcrops of limestone and limy sandstone, as well as ledges and talus slopes. This soil is similar to Hoskin cobbly loam, 30 to 70 percent slopes, eroded. It has a cover of grasses and shrubs.

The Datwyler soil has open, south-facing slopes and is in slightly more concave positions than the Hoskin soil. It is similar to Datwyler cobbly silty clay loam, 30 to 60 percent slopes, which is described under the Datwyler series.

Included in mapping were areas of rock outcrop, areas of Smarts gravelly silt loam, 30 to 70 percent slopes, and areas of Elzinga silt loam, 30 to 60 percent slopes. The Smarts and Elzinga soils are on the lower slopes and in depressions, and the vegetation is maple. The rock outcrop makes up 10 percent of the total acreage in the association, and Smarts and Elzinga soils each make up 5 percent.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hoskin-Elzinga association, eroded (30 to 70 percent slopes) (HMG2).—This mapping unit consists of soils on slopes of mountains south of Mineral Point. The landscape is characterized by parallel ridges of varying parent rock. About 40 percent of the association is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 35 percent is Elzinga silt loam, 30 to 60 percent slopes; 20 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and about 5 percent is included soils.

The Hoskin and Agassiz soils are on the slightly convex ridgetops and side slopes that have south and west aspects. The vegetation is mostly big sagebrush, bunchgrasses, and forbs on the Hoskin soil and mountain-mahogany, snowberry, bitterbrush, and ceanothus on the Agassiz soil.

The Elzinga soil has slightly concave, mainly north-facing slopes. The vegetation is maple and a sparse understory of chokecherry, wheatgrass, and false Solomons-seal.

Included in mapping were areas of Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Hoskin soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Elzinga soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hoskin-Scave association (6 to 70 percent slopes) (HNG).—This mapping unit consists of soils that are mainly south of Hardware Ranch in the Mill Creek area. These soils are on slopes of mountains. About 50 percent of the association is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 30 percent is Scave silt loam, 10 to 30 percent slopes; and 20 percent is Ant Flat loam, 6 to 20 percent slopes.

The Hoskin soil has south-facing slopes, where the vegetation is perennial grasses and shrubs. The Scave soil has north-facing slopes, where the vegetation is aspen. The Ant Flat soil is on broad ridgetops and at the heads of draws, where the vegetation is perennial grasses and shrubs.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Hoskin soil is capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Scave soil is in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Ant Flat soil is in capability unit VIe–M, non-irrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hoskin-Scout association, eroded (30 to 70 percent slopes) (HOG2).—This mapping unit consists of steep and very steep soils on James Peak in the southern part of Cache County. About 60 percent of the association is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 25 percent is Scout gravelly loam, 40 to 70 percent slopes; 5 percent is rubble land and rock outcrop; and 10 percent is minor soils.

The Hoskin soil has open slopes that face west, south, and east. This soil is similar to Hoskin cobbly loam, 30 to 70 percent slopes, except that its slopes are dominantly 30 to 60 percent. Its plant cover is big sagebrush and bunchgrasses. The Scout soil has slopes that mostly face north. It is similar to Scout gravelly loam, 40 to 70 percent slopes, except that 1 to 2 percent of its surface is covered with scattered stones. Its plant cover is Douglas-fir and alpine fir. Rock outcrop and rubble land are near the mountain, and they support little vegetation.

Included in mapping were areas of Yeates Hollow soil at the mouths of small canyons on alluvial fans.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. Trees have been harvested from areas of the Scout soil. (Hoskin soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Scout soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Hoskin-Smarts association, eroded (30 to 70 percent slopes) (HSG2).—This mapping unit is on the lower east side and upper west side of Wellsville Mountain. About 60 percent of it is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 25 percent is Smarts gravelly silt loam, 30 to 70 percent slopes; and 15 percent is rock outcrop and rock land.

The Hoskin soil is on the lower slopes of uniformly steep, somewhat dissected, south- and west-facing dip scarp slopes. It is similar to Hoskin cobbly loam, 30 to 70 percent slopes, except that its slopes are dominantly 60 to 70 percent and its surface layer is cobbly loam to gravelly loam.

The Smarts soil is in steep drainageways and near the bottom of slopes. It is similar to Smarts silt loam, 10 to 30 percent slopes, except that it is steeper and its surface layer is 20 to 30 percent gravel and is 15 to 25 inches thick.

Rock outcrop and rock land are in the form of ledges and rockslides on talus slopes.

Soils of this mapping unit are used for watershed and wildlife habitat. (Hoskin soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Smarts soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. Neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

Hoskin gravelly loam, thick surface, 1 to 6 percent slopes (HIB).—This soil is on the alluvial valley bottom of Strawberry Valley and in small areas adjacent to streams. It is somewhat less gravelly and cobbly in the subsoil than other Hoskin soils, and it has more gentle slopes.

This soil is moderately well drained, and its permeability is moderate. Runoff is slow, and the erosion hazard is slight. This soil holds 5.0 to 7.0 inches of available water to a depth of 5 feet. The water table is between depths of 40 and 60 inches late in spring and early in summer for 30 to 60 days following snowmelt. Roots penetrate to a depth of 4 feet or more but are mostly above the very gravelly material.

This soil is used for range and wildlife habitat. (Capability unit VIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hyrum Series

The Hyrum series consists of well-drained, very cobbly soils. These soils formed in alluvium and modified lake sediment derived mainly from sandstone and quartzite and, to a lesser extent, from limestone rocks. They are on high and intermediate lake terraces at elevations of 4,600 to 5,000 feet. Slopes range from 4 to 25 percent. The vegetation is big sagebrush, slender wheatgrass, western wheatgrass, and bluebunch wheatgrass. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 130 to 150 days. Hyrum soils are associated with Crowshaw, Hendricks, Hiibner, Nebeker, Mendon, and Ricks soils.

In representative profile, the surface layer is very dark grayish-brown, neutral gravelly loam about 8 inches thick. The subsoil is very dark grayish brown, dark grayish-brown, and grayish-brown, neutral very cobbly clay loam about 36 inches thick. The substratum is pale-brown, mildly alkaline very cobbly loam to a depth of 60 inches or more.

Hyrum soils are used for dryfarmed crops and for range.

Hyrum gravelly loam, 10 to 25 percent slopes (HuE).—This soil is on intermediate and high terraces, chiefly in an area west and south of the town of Mendon. Slopes are generally short and undulating.

Representative profile, one-half mile west of Mendon, 400 feet south and 900 feet west of the northeast corner of sec. 7, T. 11 N., R. 1 W.:

A1—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, granular structure; hard, friable, slightly sticky and plastic; many fine roots; many fine pores; neutral; clear, smooth boundary.

B1—8 to 17 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure that parts to moderate, fine, granular structure; hard, friable, sticky and plastic; few thin clay films; common fine roots; many fine, medium, and large pores; neutral; diffuse, smooth boundary.

B21t—17 to 31 inches, dark grayish-brown (10YR 4/2) very cobbly clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure that parts to moderate, fine, subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; many fine and medium pores; thin continuous clay films on peds; neutral; clear, smooth boundary.

B22t—31 to 42 inches, grayish-brown (10YR 5/2) very cobbly clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few fine roots; many medium and fine pores; few thin clay films on some peds; neutral.

C—42 to 60 inches, pale-brown (10YR 6/3) very cobbly loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline.

The combined thickness of the A and B horizons ranges from 30 to 45 inches. Coarse fragments are mostly cobblestone- and gravel-sized, slightly rounded and angular fragments of sandstone and quartzite rock but include fragments of limestone in places. The amount of coarse fragments ranges from 20 to 40 percent, by volume, in the A1 horizon and from 50 to 80 percent in the B and C horizons. The A1 horizon ranges from very dark grayish brown to grayish brown. Thickness ranges from 7 to 8 inches. The B2t horizon ranges from dark grayish-brown to brown. Texture ranges from very cobbly clay loam to very cobbly heavy loam. The C horizon ranges from pale brown to brown or light grayish brown. Texture ranges from very cobbly loam to very cobbly heavy very fine sandy loam. Reaction is mildly alkaline to neutral. In places, calcareous lake sediments are present at depths below 36 inches.

This soil is somewhat difficult to till. Permeability is moderate. Runoff is medium, and the erosion hazard is moderate. This soil holds 5 to 7 inches of water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more.

Included in mapping were small areas of Crowshaw gravelly loam, 3 to 6 percent slopes.

This soil is used mostly for dryfarmed crops of alfalfa or alfalfa and grass mixtures and winter wheat. Some areas are used for range. (Capability unit IVe–UX, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Hyrum gravelly loam, 4 to 8 percent slopes (HuC).—This soil is mostly on medium lake terraces at the south end of Newton Hill. It is similar to Hyrum gravelly loam, 10 to 25 percent slopes, except that it is less sloping and its surface layer is 8 to 10 inches thick. Runoff is slow, and the hazard of erosion is slight.

Included in mapping were small areas of soils that have a cobbly surface layer and small areas of Hendricks silt loam, 3 to 6 percent slopes.

This Hyrum soil is used for dryfarmed crops of winter wheat and alfalfa. (Capability unit IIIe–UX, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Hyrum cobbly loam, 4 to 8 percent slopes (HyC).—This soil is mainly in an area about a mile northeast of Newton. It is similar to Hyrum gravelly loam, 10 to 25 percent slopes, except that it is less sloping and its surface layer is about 30 percent cobblestones. The cobblestones are mostly semirounded quartzite. Runoff is slow, and the erosion hazard is slight.

Included in mapping were small areas of shallow gravelly soils.

This Hyrum soil is used mostly for dryfarmed crops of wheat. In places some of the larger cobblestones have been removed from the surface. (Capability unit IIIe–UX, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Jordan Series

The Jordan series consists of somewhat poorly drained soils that are affected by salt and alkali. These soils formed in mixed lake sediment derived mainly from limestone, sandstone, and shale. They are on low lake terraces near the valley bottom at elevations of 4,400 to 4,500 feet. Slopes are 0 to 1 percent. The vegetation is saltgrass, alkali sacaton, foxtail, peppergrass, and greasewood. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Jordan soils are associated with Lasil, Airport, Payson, Trenton, and Quinney soils.

In a representative profile, the surface layer is light brownish-gray, moderately alkaline silty clay loam about 5 inches thick. The subsoil is brown and pale-brown, moderately alkaline and strongly alkaline silty clay about 16 inches thick. The substratum is pinkish-gray to very pale-brown silty clay or silty clay loam to a depth of 60 inches or more.

Jordan soils are used mostly for range.

Jordan-Lasil silty clay loams (Jr).—This complex consists of soils on low lake terraces, mostly about 4 miles west of Smithfield. About 60 percent of the complex is Jordan silty clay loam, and 40 percent is Lasil silty clay loam. These soils are in areas made up of depressions and mounds. The Jordan soil is in the depressions, and the Lasil soil is on mounds that are 1 to 2 feet higher in elevation.

The Lasil soil is described under the Lasil series.

Representative profile of Jordan silty clay loam, in an area of Jordan-Lasil complex, ½ mile north and ¾ mile west of Amalga Church, 800 feet south and 1,300 feet east of the northwest corner of sec. 24, T. 13 N., R. 1 W.:

Ap—0 to 5 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish-brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure mixed with weak, fine and medium, granular structure; hard, friable, sticky and plastic; common fine roots; common fine pores; slightly calcareous; moderately alkaline; abrupt, smooth boundary.

B21t—5 to 10 inches, brown (7.5YR 5/2) silty clay, dark brown to brown (7.5YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots; many fine pores; thin continuous clay films; moderately calcareous; moderately alkaline; clear, wavy boundary.

B22tcasa—10 to 21 inches, pale-brown (10YR 6/3) silty clay, brown (7.5YR 5/4) when moist; moderate, coarse, prismatic structure breaking to moderate, coarse, subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots; many fine pores; thin continuous clay films; strongly calcareous; strongly alkaline; clear, smooth boundary.

C1—21 to 42 inches, very pale brown (10YR 7/3) silty clay loam, brown (7.5YR 5/3) when moist; common, medium, distinct, yellowish-red (5YR 5/6) mottles; massive; very hard, very firm, very sticky and very plastic; common fine pores; strongly calcareous; strongly alkaline.

C2—42 to 60 inches, pinkish-gray (7.5YR 7/2) silty clay, brown (7.5YR 5/3) when moist; common, medium, distinct, yellowish-red (5YR 5/6) mottles; massive; very hard, very firm, very sticky and very plastic; common fine pores; strongly calcareous; strongly alkaline.

The A horizon ranges from pale brown to light brownish gray in hues of 10YR and 7.5YR. The B2t horizon ranges from brown to light brown. Texture is dominantly silty clay but ranges to heavy silty clay loam. The outside of peds is noncalcareous, but peds are moderately or strongly calcareous when crushed. A horizon of carbonate accumulation begins in the lower part of the B horizon and extends into the C horizon in places. Calcium carbonate equivalent in the ca horizon ranges from 15 to 35 percent.

The C horizon ranges from very pale brown to brown in hues of 7.5YR and 10YR. The exchangeable sodium percentage ranges from 13 to 26 in the A horizon, from 30 to 90 in the B2t horizon, and from 45 to 80 in the C horizon. The soluble salt content ranges from 0.2 to 2.2 percent, and the highest concentration generally is in the lower part of the B2t horizon. Common, distinct mottles are at depths of 20 to 36 inches. The water table varies with the season, but it generally is at depths between 30 and 48 inches.

Permeability is slow to very slow. Runoff is slow, and the hazard of erosion is none to slight. This soil holds 7.5 to 9.0 inches of water to a depth of 5 feet, and only about 2 inches is available to plants because of the salt. Most roots are in the surface layer 10 to 13 inches above the strong concentrations of alkali and salt.

Included in mapping were small areas of Cache silty clay.

Soils of this mapping unit are used chiefly for range. (Capability unit VIIw–285, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Jordan silty clay loam (Jo).—This soil is on the broad, slightly concave, low lake terraces in the central part of Cache Valley.

Included in mapping were small areas of soils that have a silt loam surface layer and small areas of soils that have slopes of 1 to 3 percent. Also included were a few small areas of Cache silty clay.

This Jordan soil is mostly used for range. It is better suited to that purpose than to use for crops that require cultivation, but some small areas are cultivated. (Capability unit VIIw–285, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Kidman Series

The Kidman series consists of moderately well drained and well drained soils that formed in mixed lake sediment derived mainly from limestone and sandstone. These soils are on smooth to slightly undulating, medium lake terraces at elevations of 4,450 to 4,550 feet. Slopes range from 0 to 15 percent. The vegetation consists of big sagebrush, bluebunch wheatgrass, cheatgrass, and gumweed. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 130 to 150 days. Kidman soils are associated with Lewiston, Timpanogos, and Layton soils.

In a representative profile, the surface layer is brown, mildly alkaline fine sandy loam about 8 inches thick. The subsoil is brown, mildly alkaline fine sandy loam about 12 inches thick. The substratum, to a depth of 60 inches or more, is brown and pale-brown moderately alkaline fine sandy loam and sand.

Kidman soils are used for irrigated crops.

Kidman fine sandy loam, deep water table, 0 to 2 percent slopes (KfA).—This soil is on lake terraces at medium elevations in the central part of Cache Valley.

Representative profile in a cultivated area, 3 miles west and 1¾ miles south of Lewiston, 1,200 feet north and 200 feet east of the southwest corner of sec. 13, T. 14 N., R. 1 W.:

Ap—0 to 8 inches, brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure and weak, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots and few large roots; few large pores; noncalcareous; mildly alkaline; abrupt, smooth boundary.

B1—8 to 12 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots and few large roots; few fine, medium, and large pores; noncalcareous; mildly alkaline; clear, smooth boundary.

B2—12 to 20 inches, brown (7.5YR 5/3) fine sandy loam, dark brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; common fine and medium pores; few thin clay films; noncalcareous; mildly alkaline; gradual, wavy boundary.

C1—20 to 27 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 3/4) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; common fine roots and few medium roots; common fine pores; noncalcareous; mildly alkaline; clear, wavy boundary.

C2ca—27 to 43 inches, brown (7.5YR 5/4) fine sandy loam, dry and moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; few fine pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

IIC3—43 to 60 inches, pale-brown (10YR 6/3) fine sand, yellowish brown (10YR 5/4) when moist; single grain; loose, nonsticky and nonplastic; few fine roots; moderately calcareous; moderately alkaline.

The A horizon ranges from brown to dark brown or dark grayish brown. Texture ranges from fine sandy loam to very fine sandy loam or light loam. Reaction is mildly alkaline to neutral. Thickness ranges from 8 to 20 inches. The B2 horizon ranges from brown to pale brown or light brown. Texture ranges from fine sandy loam to light loam. The Cca and C horizons range from brown or pale brown to very pale brown or light yellowish brown. Texture ranges from fine sandy loam to fine sand. Reaction is moderately alkaline to strongly alkaline. The depth to the water table ranges from 40 to more than 60 inches. Distinct mottles occur at depths below 32 inches in places.

This soil is easy to work and absorbs water readily. It is moderately well drained and has moderately rapid permeability. Runoff is slow, and the hazard of water erosion is slight, but the hazard of soil blowing is moderate. This soil holds 7.5 to 8.0 inches of available water to a depth of 5 feet. Roots penetrate the soil easily to a depth of 5 feet or more.

This soil is mostly used for irrigated crops of alfalfa, sugar beets, small grain, and corn for silage and improved pasture. (Capability unit IIc-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kidman fine sandy loam, 0 to 2 percent slopes (KdA).—This level or slightly undulating soil is on broad, intermediate lake terraces in the north-central part of Cache Valley. It is similar to Kidman fine sandy loam, deep water table, 0 to 2 percent slopes, except that it is well drained. This soil is on slightly higher areas or areas adjacent to the Bear River. The water table and mottles are at a depth of more than 60 inches. The depth to the horizon of accumulated lime is commonly more than 30 inches.

Included in mapping were small areas of Preston fine sand and a few small areas of moderately well drained Kidman soils.

This soil has moderate permeability. It holds 7.5 to 8.0 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet or more.

This soil is used for irrigated crops of alfalfa, sugar beets, small grain, corn for silage, and pasture. The principal management need is the control of erosion. (Capability unit IIc-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kidman fine sandy loam, deep water table, 2 to 4 percent slopes (KfB).—This soil is on medium lake terraces, mostly in the north-central part of Cache Valley. The surface layer ranges from 10 to 16 inches in thickness.

Included in mapping were small areas of Layton loamy fine sand and small areas of well-drained Kidman soils.

This soil is used for irrigated crops and improved pasture. The main crops are alfalfa, sugar beets, small grain, and corn for silage. (Capability unit IIe-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kidman fine sandy loam, deep water table, 4 to 8 percent slopes (KfC).—This gently undulating soil is on lake terraces, mainly in small areas in the north-central part of Cache Valley. The surface layer is 8 to 12 inches thick. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Layton loamy fine sand. Also included were areas of soils that have a very fine sandy loam surface layer and a few small areas of soils that have slopes of slightly more than 8 percent.

This soil is used mainly for irrigated crops of alfalfa and small grain and for pasture. (Capability unit IIIe-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kidman fine sandy loam, 8 to 15 percent slopes (KdD).—This soil is in relatively small, widely separated tracts on terrace breaks, mainly in association with other Kidman soils. It is similar to Kidman fine sandy loam, deep water table, 0 to 2 percent slopes, except that it is more sloping, it is well drained, and the water table is below a depth of 60 inches. The surface layer is 7 to 12 inches thick. Runoff is medium, and the hazard of erosion is moderate.

The soil is used for irrigated crops and pasture. Alfalfa and small grain are the principal crops. (Capability unit IVe-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kirkham Series

The Kirkham series consists of somewhat poorly drained soils that formed in stratified, calcareous alluvium derived from limestone, sandstone, and quartzite. These soils are on flood plains of the Little Bear and Cub Rivers. Elevation ranges from 4,450 to 4,500 feet, and slopes are 0 to 1 percent. The vegetation is saltgrass, Kentucky bluegrass, sedges, wiregrass, and gumweed. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Kirkham soils are associated with Shay and Winn soils.

In a representative profile, the surface soil is grayish-brown, moderately alkaline silt loam about 9 inches thick. The next layer is grayish-brown, mildly alkaline silty clay loam about 14 inches thick. Below this, to a depth of 60 inches and more, is light brownish-gray, mildly alkaline heavy silt loam that is highly stratified. The profile is strongly calcareous throughout.

Kirkham soils are used for irrigated crops and unimproved pasture.

Kirkham-Shay complex (Ks).—This complex is mostly on the flood plain of the Little Bear and Cub Rivers. About 60 percent of the complex is Kirkham silt loam and about 40 percent is Shay silty clay loam. Slopes range from 0 to 1 percent.

Representative profile of Kirkham silt loam in an area of Kirkham-Shay complex, located north of Richmond, 1,200 feet south and 300 feet west of the northeast corner of sec. 21, T. 14 N., R. 1 E.:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; strongly calcareous; moderately alkaline; abrupt, smooth boundary.

C1—9 to 15 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many medium pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

C2—15 to 23 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many medium and fine pores; few, fine, distinct mottles; strongly calcareous; mildly alkaline; clear, wavy boundary.

C3—23 to 60 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, sticky and plastic; few fine roots; many fine and medium pores and a few large pores; few, fine, faint mottles; strongly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to grayish brown in a hue of 10YR. Texture ranges from silt loam to light silty clay loam. Reaction ranges from mildly alkaline to strongly alkaline. The C horizon ranges from grayish brown or light brownish gray to gray or pale brown in hues of 10YR and 2.5Y. This horizon is highly stratified. It ranges from silty clay loam to silt loam that has thin strata of fine sandy loam or loamy fine sand. In places gravel and sand are at a depth below 40 inches. The water table fluctuates seasonally and with the water level in the streams, but it commonly is at a depth below 30 to 50 inches. In years when runoff is high, this soil is subject to overflow for short periods.

This soil is fairly easy to till. Permeability is moderately slow. Runoff is slow, and the hazard of erosion is slight. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more.

Included in mapping were small areas of Winn silt loam, 0 to 3 percent slopes, and small areas of gravelly alluvial land.

Soils of this mapping unit are used for irrigated crops of sugar beets, alfalfa, small grain, and corn for silage. Some areas are in native pasture. (Capability unit IIw–2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Kirkham-Shay complex, strongly alkali (Kt).—This complex is on the Cub River flood plain, mainly near its junction with the Bear River. About 50 percent of the complex is Kirkham silt loam, and about 50 percent is Shay silty clay loam. These soils are similar to other Kirkham and Shay soils, except that they are strongly affected by salt and alkali. In addition, stratification in the profile is not so pronounced and strata of gravel and sand are thin or entirely absent. The surface is uneven and is dotted with oxbows and wet spots.

Included in mapping were small areas of Airport silty clay loam, 0 to 1 percent slopes.

Soils of this mapping unit are used mainly for native pasture. Small areas surrounded by larger tracts of other soils are used for irrigated or dryfarmed crops of alfalfa and small grain. (Capability unit IVw–28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Lakewin Series

The Lakewin series consists of somewhat excessively drained soils. These soils formed in mixed sandy and gravelly alluvium and modified lake sediment derived from limestone, quartzite, and sandstone. They are on old lake bars and medium lake terraces. Elevations range from 4,740 to 4,800 feet, and slopes range from 0 to 3 percent. The vegetation is Indian ricegrass, cheatgrass, annual sunflower, big rabbitbrush, and big sagebrush. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 46° to 47° F., and the frost-free season is 120 to 140 days. Lakewin soils are associated with Sterling, Ricks, Layton, and Kidman soils.

In a representative profile, the surface layer is dark grayish-brown, neutral to mildly alkaline gravelly coarse sandy loam about 18 inches thick. The next layer is brown, mildly alkaline gravelly loamy sand or gravelly sandy loam about 9 inches thick. Below this is light brownish-gray, strongly calcareous, moderately alkaline gravel and sand to a depth of 60 inches or more.

Lakewin soils are used mainly for dryfarming.

Lakewin gravelly coarse sandy loam (La).—This soil is on old lake bars or intermediate lake terraces south and west of the city of Hyrum. Slope ranges from 0 to 2 percent.

Representative profile one-half mile east of Sterling Crossroads, 800 feet south of the northwest corner of the northeast quarter of sec. 13, T. 10 N., R. 1 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; 25 percent fine gravel; many fine pores; neutral; clear, smooth boundary.

A1—7 to 18 inches, dark grayish-brown (10YR 4/2) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; few medium roots and common fine roots; 25 percent gravel; many fine and medium pores; mildly alkaline; clear, wavy boundary.

C1—18 to 27 inches, brown (10YR 5/3) gravelly loamy sand, dark brown (10YR 3/3) when moist; single grain; loose, nonsticky and nonplastic; many fine roots; many fine and medium pores; noncalcareous; 30 percent gravel; mildly alkaline; gradual, wavy boundary.

C2ca—27 to 34 inches, brown (10YR 5/3) gravelly loamy sand, dark brown (7.5YR 3/4) when moist; single grain; loose, nonsticky and nonplastic; common fine roots; slightly calcareous, but strongly calcareous coatings on underside of pebbles; 40 percent gravel; mildly alkaline; clear, wavy boundary.

C3ca—34 to 60 inches, light brownish-gray (10YR 6/2) very gravelly sand, brown (10YR 5/3) when moist; single grain; loose, nonsticky and nonplastic; strongly calcareous; 40 percent gravel; moderately alkaline.

The A horizon ranges from dark grayish brown to brown. Texture ranges from gravelly coarse sandy loam to gravelly sandy loam. The pebbles are mostly less than one-half inch in diameter, and the gravel content ranges from 15 to 30 percent. The C horizon ranges from brown or light brownish gray to light brown or pale brown in a hue of 10YR or 7.5YR. Texture ranges from gravelly loamy sand to gravelly sandy loam in the upper part of the horizon and to gravel and sand in the lower part. Gravel content ranges from 20 to 40 percent in the C1 horizon and from 25 to 75 percent in the C2ca horizon. The underside of many of the pebbles in the C2ca horizon is coated with lime. Reaction ranges from mildly alkaline to strongly alkaline.

Included in mapping were small areas of Kidman fine sandy loam, 0 to 2 percent slopes.

The Lakewin soil is fairly easy to till, but gravel causes excessive wear on tillage implements. Permeability is rapid. Runoff is slow or very slow, and the hazard of erosion is slight. This soil holds 3.0 to 3.75 inches of available water to a depth of 5 feet. Roots are mostly in the upper 2 to 3 feet, and only a few roots extend into the very gravelly material.

This soil is used mainly for dryfarmed crops of small grain. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

LaPlatta Series

The LaPlatta series consists of well-drained soils that formed in residuum derived from light-colored tuff, conglomerate, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are on dominantly north- and east-facing mountain slopes at elevations of 5,000 to 7,000 feet. Slopes range from 10 to 50 percent. The vegetation is bluebunch wheatgrass, Great Basin wildrye, tall native bluegrass, Sandberg bluegrass, big sagebrush, bitterbrush, and serviceberry. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 40° to 44° F., and the frost-free season is 80 to 100 days. La Platta soils are associated with Barfuss, Leatham, Wheelon, Munk, and Obray soils.

In a representative profile, the surface layer is very dark gray, slightly acid silty clay loam about 8 inches thick. The subsoil is very dark-gray to light brownish-gray, slightly acid or neutral clay about 40 inches thick. The substratum is white, strongly calcareous, strongly alkaline silt loam to a depth of 60 inches or more. Carbonates have been leached from the surface layer and subsoil and redeposited in the substratum.

Representative profile of LaPlatta silty clay loam in an area of Barfuss-Leatham association (30 to 50 percent slopes) approximately 400 feet north and 1,600 feet west of the southeast corner of sec. 5, T. 9 N., R. 1 E.:

A1—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; hard, firm, sticky and slightly plastic; many fine and very fine roots; common, very fine, dicontinuous, exped, interstitial pores; slightly acid; clear, smooth boundary.

B21t—8 to 12 inches, very dark gray (10YR 3/1) silty clay, black (10YR 2/1) when moist; strong, medium, subangular blocky structure; very hard, very firm, sticky and plastic; common fine and very fine roots; few very fine tubular pores; few thin clay films on pores; slightly acid; gradual, smooth boundary.

B22t—12 to 26 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; strong, coarse, prismatic structure; extremely hard, very firm, very sticky and plastic; common fine and very fine roots; few very fine pores; common thin clay films in pores and on ped surfaces; slightly acid; gradual, wavy boundary.

B23t—26 to 35 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; strong, coarse, prismatic structure; extremely hard, very firm, very sticky and plastic; few very fine roots; common very fine tubular pores; common thin clay films in pores and on peds; neutral; clear, smooth boundary.

B3ca—35 to 48 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak subangular blocky structure; hard, firm, sticky and slightly plastic; common fine roots; common very fine interstitial pores; strongly calcareous, lime is nonindurated, massive, and nodular; strongly alkaline; gradual, wavy boundary.

Cca—48 to 60 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; common very fine interstitial pores; very strongly calcareous, lime is nonindurated and massive; strongly alkaline.

The combined thickness of the A1 and B2t horizons ranges from 28 to 40 inches over the horizon of accumulated carbonate. Carbonates generally are in the lower part of the B horizon but, in places, are in only the Cca and C horizons. The A1 horizon ranges from very dark gray to dark gray. Texture is dominantly silty clay loam but ranges to silt loam. Reaction ranges from slightly acid to mildly alkaline. Thickness is 5 to 11 inches. The B2t horizon ranges from very dark gray or dark grayish brown to grayish brown. Texture ranges from clay or silty clay to heavy silty clay loam. Reaction ranges from slightly acid to mildly alkaline. The soil generally is noncalcareous, but in places it is slightly calcareous in the lower part below a depth of 28 inches. The Cca and C horizons range from white to light grayish brown or pale brown in a hue of 10YR or 2.5Y. Texture ranges from silt loam or very fine sandy loam to silty clay loam. Reaction ranges from mildly alkaline to strongly alkaline, and these horizons are strongly calcareous to very strongly calcareous.

LaPlatta soils are used for range, watershed, and wildlife habitat.

LaPlatta silty clay loam, 30 to 50 percent slopes (LCG).—This steep soil is on north- and east-facing mountain slopes, south of Hardware Ranch and west of Anderson Ranch.

Permeability is moderately slow. Runoff is rapid, and the hazard of erosion is high. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more, but are mostly at a depth of less than 30 inches.

This soil is used for range, watershed, and wildlife habitat. Capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3)

LaPlatta-Obray association (6 to 30 percent slopes) (LGE).—This mapping unit is mostly in the Davenport Creek and Little Bear River drainage area. A smaller area is on the Clarkston Mountain. About 55 percent of the association is LaPlatta silty clay loam, 10 to 30 percent slopes; 25 percent is Obray silty clay, 6 to 20 percent slopes; 15 percent is Barfuss silt loam, 10 to 30 percent slopes; and 5 percent is included soils.

The strongly sloping to moderately steep LaPlatta soil is on slightly concave mountain slopes. The vegetation is sagebrush, slender wheatgrass, tall native bluegrass, yarrow, geranium, and scattered clumps of scrubby aspen. Runoff is medium, and the hazard of erosion is moderate.

The strongly sloping Obray soil is in terracelike areas between steep slopes. The vegetation is mulesear dock, slender wheatgrass, low sagebrush, and Sandberg bluegrass.

The Barfuss soil is on slightly convex ridges and moderately steep mountain slopes. It is described under the Barfuss series. The vegetation is sagebrush, bitterbrush, Great Basin wildrye, and western wheatgrass. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were areas of a deep, fine-textured, extremely stony soil and areas of Leatham silt loam, 30 to 50 percent slopes. The extremely stony soil makes up 3 percent of the association and is in shallow gullies. The Leatham soil makes up 2 percent of the association and is on convex ridges.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (LaPlatta soil is in capability unit VIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. Obray soil is in capability unit VIe–M5, nonirrigated; Mountain Clay range site. Barfuss soil is in capability unit VIIe–MN; not in a range site. None of the soils is in a woodland suitability group; all of the soils are in wildlife suitability group 3)

Lasil Series

The Lasil series consists of somewhat poorly drained soils that are affected by salt and alkali. These soils formed in mixed lake sediment. They are on low lake terraces at elevations of 4,430 to 4,500 feet. Slopes range from 0 to 3 percent. The vegetation is greasewood, saltgrass, foxtail, gumweed, and annual mustard. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Lasil soils are associated with Jordan, Trenton, and Cache soils.

In a representative profile, the surface layer is light brownish-gray, neutral silty clay loam about 5 inches thick. The subsoil is light brownish-gray, pinkish-gray, and brown, moderately alkaline heavy silty clay loam about 34 inches thick. The substratum is light-brown, moderately alkaline or strongly alkaline heavy silty clay loam to a depth of 60 inches or more.

Representative profile of Lasil silty clay loam in an area of Jordan-Lasil silty clay loams, ½ mile north and ¾ mile west of Amalga Church, 800 feet south and 1,100 feet west of the northwest corner of sec. 24, T. 13 N., R. 1 W.:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy structure that parts to weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; slightly calcareous; neutral; abrupt, smooth boundary.

B1—5 to 13 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; slightly calcareous; moderately alkaline; clear, smooth boundary.

B21t—13 to 23 inches, pinkish-gray (7.5YR 6/2) heavy silty clay loam, brown (7.5YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, fine subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many fine pores; thin continuous clay films; slightly calcareous; moderately alkaline; gradual, smooth boundary.

B22t—23 to 32 inches, pinkish-gray (7.5YR 6/2) heavy silty clay loam, brown (7.5YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, fine, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine pores; thin continuous clay films; moderately calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—32 to 39 inches, brown (7.5YR 5/2) heavy silty clay loam, dark brown to brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine and medium pores; moderately calcareous; moderately alkaline; gradual, smooth boundary.

Cca—39 to 60 inches, light-brown (7.5YR 6/3) heavy silty clay loam, brown (7.5YR 5/3) when moist; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; massive; very hard, firm, sticky and very plastic; few fine pores; strongly calcareous; moderately alkaline.

The combined thickness of the A1, B1, and B2t horizons ranges from 27 to 33 inches above the ca horizon. The A1 horizon ranges from grayish brown to dark grayish brown or brown. Texture is dominantly silty clay loam but ranges to heavy silt loam. Reaction ranges from neutral to moderately alkaline. Thickness ranges from 3 to 8 inches. The B2t horizon is pinkish gray to brown or to light brown. Texture ranges from heavy silty clay loam to silty clay loam. Reaction is moderately alkaline to very strongly alkaline. The exchangeable sodium percentage ranges from 20 to 50. The Cca horizon is light brown to pinkish gray. Texture ranges from heavy silt loam to heavy silty clay. Reaction ranges from moderately alkaline to very strongly alkaline. The exchangeable sodium percentage ranges from 20 to 70. The calcium carbonate equivalent is 15 to 30 percent. Distinct, yellowish-red (5YR 5/6) to strong-brown (7.5YR 5/6) mottles are at a depth below 32 inches.

Permeability is very slow. Runoff is slow, and the hazard of erosion is slight to none. These soils hold 3 to 6 inches of available water to a depth of 5 feet. Roots are mostly in the uppermost 20 inches, above the horizon that contains strong alkali.

Lasil soils are mainly used for native range. A few small areas are cultivated.

In this survey area, the Lasil soils are not mapped separately but are mapped in a complex with Jordan soils.

Layton Series

The Layton series consists of moderately well drained soils that formed in mixed lake sediment derived dominantly from sandstone, limestone, and quartzite. These soils are on medium terraces on the Lewiston Bench at elevations of 4,400 to 4,550 feet. Slopes range from 0 to 1 percent. The vegetation is Indian ricegrass, bluebunch wheatgrass, cheatgrass, big rabbitbrush, and big sagebrush. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 130 to 140 days. Layton soils are associated with Kidman, Lewiston, Preston, and Timpanogos soils.

In a representative profile, the surface layer is dark grayish-brown to brown, neutral to mildly alkaline loamy fine sand about 13 inches thick. The next layer is brown, moderately alkaline loamy fine sand about 14 inches thick. The substratum is brown to light-brown, moderately alkaline loamy fine sand and fine sand to a depth of 60 inches or more. Carbonates have mostly been leached from the surface layer and subsoil and accumulated in the substratum at a depth of 36 to 50 inches.

Layton soils are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage.

Layton loamy fine sand (Lh).—This slightly undulating soil is on lake terraces at medium elevations, mainly in the Lewiston-Cornish area. Slopes are 0 to 1 percent.

Representative profile in an irrigated area, 1¼ miles north and ⅜ mile west of Lewiston, 1,000 feet north and 800 feet east of the southwest corner of the southeast quarter of sec. 32, T. 15 N., R. 1 E.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure to single grain; soft, very friable, nonsticky and nonplastic; many fine roots; neutral; abrupt, smooth boundary.

A1—6 to 13 inches, brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine pores and few large pores; noncalcareous; mildly alkaline; clear, wavy boundary.

AC—13 to 27 inches, brown (7.5YR 5/2) loamy fine sand, dark brown (7.5YR 3/2) when moist; massive; soft, very friable, nonsticky and nonplastic; many fine roots; many fine, medium, and large pores; noncalcareous; moderately alkaline; gradual, wavy boundary.

C1—27 to 35 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many medium and fine pores; noncalcareous; moderately alkaline; gradual, wavy boundary.

C2—35 to 46 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) when moist; common, medium, distinct, yellowish-red (5YR 4/6) mottles; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many fine pores; noncalcareous; moderately alkaline; clear, wavy boundary.

C3ca—46 to 66 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; common, coarse, distinct, dark reddish-brown (5YR 3/4) mottles; massive; soft, very friable, nonsticky and nonplastic; moderately calcareous; moderately alkaline.

The A horizon ranges from dark grayish brown to grayish brown or to brown in a hue of 10YR. Texture ranges from loamy fine sand to light fine sandy loam. Reaction is neutral to mildly alkaline. Thickness ranges from 6 to 14 inches. The C horizon ranges from brown to light brown or pale brown in a hue of 7.5YR or 10YR. Texture ranges from loamy fine sand to fine sand or to light fine sandy loam. The calcium carbonate equivalent of the C3ca horizon ranges from 8 to 20 percent. Depth to the water table and reddish-brown mottles is most commonly from 40 to 60 inches. In places the substratum is strongly calcareous.

This soil is rapidly permeable. Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is slight to moderate. This soil holds 5 to 7 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet.

Included with this soil in mapping were small areas of Layton soils that have slopes of 1 to 3 percent, and areas of well-drained soils.

This soil is used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage. (Capability unit IIIs-24, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Leatham Series

The Leatham series consists of well-drained soils that formed in material weathered from light-colored, very strongly calcareous, tuff, conglomerate, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are mainly on south- and west-facing mountain slopes at elevations of 5,200 to 6,000 feet. Slopes range from 30 to 50 percent. The vegetation is bluebunch wheatgrass, native bluegrass, giant wildrye, cheatgrass, oyster plant, mulesear dock, balsamroot, bitterbrush, big sagebrush, and serviceberry. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature is 42° to 45° F., and the frost-free season is 80 to 100 days. Leatham soils are associated with Barfuss, LaPlatta, and Wheelon soils.

In a representative profile, the surface layer is gray, strongly calcareous, neutral silt loam about 10 inches thick. The next layer and the substratum are light-gray to white, very strongly calcareous, mildly alkaline silt loam or light silty clay loam to a depth of 60 inches or more.

Leatham soils are used for range, watershed, and wildlife habitat.

Leatham-Barfuss association, eroded (30 to 50 percent slopes) (LMG2).—This mapping unit is on the rolling foothills east of the Smithfield-Richmond area. About 50 percent of the association is Leatham silt loam, 30 to 50 percent slopes; 20 percent is Barfuss silt loam, 30 to 50 percent slopes; 20 percent is Wheelon silt loam, 30 to 50 percent slopes; and 10 percent is included soils.

Generally the Leatham soil has slopes that face south and west; the Wheelon soil is on convex ridges; and the Barfuss soil is in slightly concave areas and has north-facing slopes. The vegetation on these soils is perennial grasses, forbs, and shrubs.

Representative profile of Leatham silt loam, 30 to 50 percent slopes, in an area of Leatham-Barfuss association, eroded, 1½ miles east of Crow Mountain, 1,000 feet west of the east quarter corner of sec. 12, T. 13 N., R. 1 E.:

A11—0 to 4 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, medium, platy structure that parts to moderate, fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine, medium, and large roots; many fine pores; strongly calcareous; neutral; abrupt, smooth boundary.

A12—4 to 10 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, coarse, subangular blocky structure that parts to moderate, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine, medium, and large roots; many fine and medium pores and a few large pores; strongly calcareous; neutral; clear, wavy boundary.

AC—10 to 15 inches, light-gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many fine and medium roots and a few large roots; many fine and medium pores and a few large pores; very strongly calcareous; mildly alkaline; gradual, wavy boundary.

C1ca—15 to 25 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; very hard, friable, nonsticky and slightly plastic; many fine and medium roots and a few large roots; many fine and medium pores; very strongly calcareous; mildly alkaline; gradual, wavy boundary.

C2ca—25 to 39 inches, white (2.5Y 8/1) silty clay loam, light gray (2.5Y 7/2) when moist; massive; very hard, very friable, nonsticky and slightly plastic; few fine roots; many fine and medium pores; very strongly calcareous; mildly alkaline; gradual, irregular boundary.

C3ca—39 to 60 inches, same as C2ca horizon except that it contains many pockets of weathering volcanic ash that is noncalcareous and has colors lighter than N 8/0; these pockets make up about one-third of the volume of the horizon.

The A horizon ranges from 8 to 12 inches in thickness.

Permeability is moderate. Runoff is rapid, and the hazard of erosion is high. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were areas of LaPlatta silty clay loam, 10 to 30 percent slopes, in depressions and swales.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Leatham soil is in capability unit VIIe-U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2. Barfuss soil is in capability unit VIIe-MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3)

Lewiston Series

The Lewiston series consists of somewhat poorly drained soils that are affected by salt and alkali. These soils formed in mixed lake sediment derived from limestone and sandstone rocks. They are on low lake terraces, mainly in the Lewiston-Trenton area, at elevations of 4,430 to 4,500 feet. Slopes range from 0 to 3 percent. The vegetation is saltgrass, foxtail, alkali sacaton, and Great Basin wildrye. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 130 to 150 days. Lewiston soils are associated with Kidman, Layton, and Trenton soils.

In a representative profile, the surface layer is grayish-brown to brown, mildly alkaline to moderately alkaline very fine sandy loam about 13 inches thick. The next layer is light-gray, moderately alkaline or strongly alkaline fine sandy loam about 19 inches thick. Below this is pinkish-gray, strongly alkaline loamy fine sand to a depth of 60 inches or more.

Lewiston soils are used for irrigated crops and pasture.

Lewiston fine sandy loam (Ln).—This soil is mostly on low lake terraces in the vicinity of Lewiston and south to the Benson area. Slopes range from 0 to 3 percent.

Representative profile in a cultivated field, 1¼ miles west and 1¼ miles south of Lewiston, 850 feet north and 110 feet east of the southwest corner of the northeast quarter of sec. 18, T. 14 N., R. 1 E.:

Ap—0 to 10 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular and weak, coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few fine pores; slightly calcareous; mildly alkaline; clear, smooth boundary.

A1—10 to 13 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, fine, granular and weak, coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few fine pores; slightly calcareous; moderately alkaline; clear, wavy boundary.

C1ca—13 to 22 inches, light-gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) when moist; common, medium, faint, grayish-brown (10YR 5/2) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; many fine and medium pores; strongly calcareous; moderately alkaline; clear, smooth boundary.

C2ca—22 to 32 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; common, medium, faint, yellowish-brown (10YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few fine pores; strongly calcareous; strongly alkaline.

C3—32 to 60 inches, pinkish-gray (7.5YR 7/2) loamy fine sand, light brown (7.5YR 6/4) when moist; many, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few fine pores; strongly calcareous; strongly alkaline.

The A horizon ranges from grayish brown to dark grayish brown or to brown. Reaction ranges from mildly alkaline to strongly alkaline. Thickness ranges from 8 to 16 inches. The C and Cca horizons range from brown to pale brown, light brown, or pinkish gray in a hue of 10YR or 7.5YR. Texture ranges from fine sandy loam to light loam or to loamy fine sand. Distinct, yellowish-brown or yellowish-red mottles are in the subsoil and substratum.

This soil is easy to till. Permeability is moderately rapid. Runoff is slow or very slow, and the hazard of erosion is slight. This soil holds 5 to 7 inches of available water to a depth of 5 feet. The water table is at a depth ranging from 30 to 40 inches and fluctuates seasonally. Roots penetrate easily to the water table.

Included in mapping were small areas of Kidman fine sandy loam, deep water table, 0 to 2 percent slopes, a few small areas of soils that have a hardpan, and areas of alkali soils.

This soil is used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage, and for improved pasture. (Capability unit IIw-26, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Lewiston fine sandy loam, strongly alkali (Lo).—This soil is in lower lying areas on low lake terraces. It is similar to Lewiston fine sandy loam, but because of its low position, the water table is higher. The depth to the water table is 10 to 30 inches. This high water table has caused a strong accumulation of alkali and moderate amounts of salts near the surface.

This soil is used for irrigated crops of barley and alfalfa, or for improved pasture or range. (Capability unit IVw-28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Logan Series

The Logan series consists of poorly drained and very poorly drained soils that have a heavy silty clay loam subsoil. These soils formed in mixed alluvium and lake sediment derived from limestone, sandstone, and quartzite. They are on flood plains of streams and low lake terraces at elevations of 4,420 to 4,500 feet. Slopes range from 0 to 3 percent. The vegetation is saltgrass, Kentucky bluegrass, wiregrass, sedges, and cattails. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Logan soils are associated with Roshe Springs, Salt Lake, Cardon, Collett, Greenson, and Airport soils.

In a representative profile, the surface layer is very dark gray, mildly alkaline, strongly calcareous silty clay loam about 13 inches thick. The next layer is gray, moderately alkaline, very strongly calcareous heavy silty clay loam about 13 inches thick. Below this is light-gray, moderately alkaline, strongly calcareous silty clay to a depth of 60 inches or more. The substratum is gleyed.

Logan soils are used mostly for native pasture and meadow hay. Some areas have been drained and are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage, and for improved pasture.

Logan silty clay loam (Lr).—This soil is in smooth areas or in slight depressions on low lake terraces and flood plains in the central part of Cache Valley. Slopes range from 0 to 3 percent.

Representative profile, located in a wet meadow area, 1 mile south and 1 mile east of Mendon Post Office, 1,100 feet south and 500 feet east of the northwest corner of the northeast quarter of sec. 16, T. 11 N., R. 1 W.:

O2—2 inches to 0, peat.

A1—0 to 13 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, sticky and plastic; many fine, medium, and large roots; common fine pores; strongly calcareous; mildly alkaline; gradual, smooth boundary.

C1cag—13 to 26 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, dark gray (2.5Y 4/1) when moist; massive; hard, firm, sticky and plastic; common fine roots and few medium roots; many fine and medium pores; very strongly calcareous; moderately alkaline; clear, smooth boundary.

C2g—26 to 45 inches, light-gray (5Y 7/1) silty clay, gray (5Y 6/1) when moist; massive; extremely hard, very firm, very sticky and very plastic; few fine and medium roots; common fine pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C3g—45 to 60 inches, light-gray (5Y 7/1) silty clay, olive gray (5Y 5/2) when moist; common, medium, distinct, grayish-brown (10YR 5/2) mottles; massive; extremely hard, very firm, very sticky and very plastic; few fine and medium roots; common fine pores; strongly calcareous; moderately alkaline.

A peat horizon as much as 2 inches thick is on the surface in areas where this soil has not been cultivated. The A1 horizon ranges from 10 to 16 inches in thickness and from heavy silt loam to silty clay loam in texture. Mottles of grayish brown to yellowish brown commonly occur below a depth of 20 inches.

This soil is easy to till if it is drained. Permeability is slow. Runoff is slow to ponded, and the hazard of erosion is none to slight. If this soil is drained, it holds 9 to 11 inches of available water to a depth of 5 feet. The depth to the water table commonly is 14 to 40 inches, but some areas are ponded for part of the year. In places this soil has been drained and the water table is below a depth of 40 inches. Most plant roots are above the water table.

Included in mapping were small areas of Greenson loam, 0 to 3 percent slopes, and small areas of Salt Lake silty clay. Also included were a few small areas of soils that are affected by salt and alkali.

This soil is used mainly for meadow hay and pasture. Some small areas are drained and are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage. (Capability unit IIIW-25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Lucky Star Series

The Lucky Star series consists of well-drained soils that formed in residuum and colluvium derived dominantly from sandstone. These soils are on mountains at elevations of 7,000 to 8,500 feet. Slopes range from 6 to 60 percent. The vegetation is aspen and an understory of snowberry, chokeberry, mountain brome, blue wildrye, slender wheatgrass, bluebell, peavine, and oniongrass. The average annual precipitation is 25 to 35 inches, the mean annual air temperature is 36° to 46° F., and the mean soil temperature is less than 59°. The frost-free season is 80 to 100 days. Lucky Star soils are associated with Agassiz, Curtis Creek, Despain, Fitzgerald, Flygare, Goring, Hoskin, Mult, Red Spur, and Scout soils.

In a representative profile, the surface layer is very dark grayish-brown, slightly acid gravelly silt loam about 13 inches thick. The subsurface layer is pink, medium acid very cobbly fine sandy loam about 22 inches thick. Below this is a layer of light-brown and reddish-brown, medium acid to slightly acid very cobbly fine sandy loam and very cobbly sandy clay loam about 35 inches thick. The substratum is light-brown, slightly acid very cobbly light loam to a depth of 72 inches or more.

Lucky Star soils are used for range, watershed, woodland, and wildlife habitat.

Lucky Star gravelly silt loam, 30 to 60 percent slopes

(LTG).—This soil is on the sides of mountains.

Representative profile, located in south Cottonwood Canyon, 2,400 feet west and 1,800 feet north of the southeast corner of sec. 31, T. 10 N., R. 3 E.:

O1—1 inch to 0, matted leaves and twigs.

A1—0 to 13 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many medium and fine roots and few large roots; 30 percent gravel and cobblestones; slightly acid.

A2—13 to 35 inches, pink (7.5YR 7/3) very cobbly fine sandy loam, brown (7.5YR 5/3) when moist; massive; soft, very friable, nonsticky and nonplastic; common medium and very fine roots and few large roots; common medium and fine interstitial pores; 50 to 60 percent cobblestones and gravel; medium acid; gradual, irregular boundary.

A2&B2t—35 to 55 inches, mixed A2 and B2t horizons (60 percent A2, and 40 percent B2t); the A2 part is light-brown (7.5YR 6/4) very cobbly fine sandy loam, brown (7.5YR 5/4) when moist; the B2t part is reddish-brown (5YR 5/4) very cobbly sandy clay loam, reddish brown (5YR 4/4) when moist; massive; soft, friable, slightly sticky and nonplastic; common fine and medium roots and few large roots; few medium and many very fine interstitial pores; 50 to 60 percent cobblestones and gravel; many clay films in pores and on cobblestones and gravel, and very few on ped surfaces; medium acid; clear, wavy boundary.

B2t&A2—55 to 70 inches, mixed B2t and A2 horizons (60 percent B2t, and 40 percent A2); the B2t part is reddish-brown (5YR 5/4) very cobbly sandy clay loam, reddish brown (5YR 4/4) when moist, and the A2 part is light-brown (7.5YR 6/4) very cobbly fine sandy loam, brown (7.5YR 5/4) when moist; moderate, medium, prismatic structure; hard, firm, sticky and plastic; moderately thick continuous clay films on ped surfaces and common moderately thick clay films in pores; few medium and fine roots; common medium and large pores; 50 to 70 percent cobblestones and gravel; slightly acid; clear, irregular boundary.

C—70 to 72 inches, light-brown (7.5YR 6/4) very cobbly light loam, mixed brown (7.5YR 5/4) and reddish brown (5YR 4/4) when moist; very cobbly clay loam; massive; soft and hard, friable and firm, nonsticky and sticky, and nonplastic and plastic; few medium and fine roots; many medium and large interstitial pores; 50 to 70 percent cobblestones and gravel; slightly acid.

The combined thickness of the A1, A2, and B2t horizons ranges from 50 to 70 inches. The A1 horizon ranges from very dark grayish brown to dark brown in a hue of 10YR or 7.5YR. Reaction ranges from medium acid to neutral. Thickness ranges from 10 to 16 inches. The A2 horizon ranges from pink to light brown, very pale brown, or pale brown in a hue of 10YR, 7.5YR, or 5YR. Texture ranges from very cobbly fine sandy loam or cobbly fine sandy loam to very cobbly loamy fine sand. The A2 horizon tongues into the B2t horizon. The B2t horizon ranges from reddish brown to red or pink in a hue of 7.5YR, 5YR, or 2.5YR. Texture ranges from very cobbly sandy clay loam or very cobbly heavy loam to very cobbly light clay loam. Angular or rounded sandstone and quartzite fragments the size of cobblestones and gravel are throughout the profile. The content of coarse fragments ranges from 10 to 30 percent in the A1 horizon, from 30 to 70 percent in the A2 horizon, and from 50 to 80 percent in the B2t and C horizons.

Permeability is moderate. This soil holds about 5 to 7 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more. Runoff is rapid, and the hazard of erosion is high.

Included in mapping were areas of Scave silt loam, 10 to 30 percent slopes, and small areas of soils that have an extremely stony surface layer.

This soil is used for range, watershed, woodland, and wildlife habitat. (Capability unit VIIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2r1; wildlife suitability group 4)

Lucky Star silt loam, 6 to 30 percent slopes (LSE).—This soil is on mountains. It is similar to Lucky Star silt loam, 30 to 60 percent slopes, except that it is not so steep and its surface layer is essentially free of gravel and cobblestones. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Lucky Star gravelly silt loam, 30 to 60 percent slopes, and areas of St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes. Also included are small areas of Scout soils and areas where the surface layer is extremely stony.

This Lucky Star soil is used for range, watershed, woodland, and wildlife habitat. (Capability unit VIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Lucky Star-Goring association (6 to 30 percent slopes) (LUE).—This mapping unit consists of soils on mountains, mostly west of Ant Flat Road near the Weber County line, and in smaller scattered areas. About 65 percent of the association is Lucky Star silt loam; about 25 percent is Goring silt loam; and 10 percent is included soils.

The Lucky Star soil is similar to Lucky Star gravelly silt loam, 30 to 60 percent slopes, except that it is less sloping and its surface layer is essentially free of gravel and cobblestones. The vegetation is aspen. On the Goring soil the vegetation is grasses, shrubs, and forbs.

Included in mapping were areas of Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded, and Ant Flat loam, 6 to 20 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Lucky Star soil is in capability unit VIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; and wildlife suitability group 4. Goring soil is in capability unit VIe-M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Lucky Star-Hoskin association (6 to 30 percent slopes) (LVE).—This mapping unit is on the north-facing slopes of mountains in the La Plata mine area. About 70 percent of the association is Lucky Star silt loam, 6 to 30 percent slopes; 25 percent is Hoskin cobbly loam, 10 to 30 percent slopes; and about 5 percent is included soils.

The Lucky Star soil is similar to Lucky Star gravelly silt loam, 30 to 60 percent slopes, except that it is less sloping and its surface layer is essentially free of gravel and cobblestones. The vegetation is aspen.

The Hoskin soil is similar to Hoskin silt loam, 30 to 70 percent slopes, except that it is less sloping and less eroded. The surface ranges from 10 to 15 inches in thickness. Runoff is medium, and the hazard of erosion is moderate. The vegetation is snowberry, chokecherry, and grasses.

Included in mapping were areas of Scout gravelly loam, 10 to 40 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Lucky Star soil is in capability unit VIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Hoskin soil is in capability unit VIe-M, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Lucky Star-Red Spur complex, 6 to 30 percent slopes (LWE).—This complex consists of soils on all exposures on the sides of high mountains west of Monte Cristo. Elevation ranges from 7,500 to 8,500 feet. About 45 percent of the complex is Lucky Star silt loam, 6 to 30 percent slopes; about 35 percent is Red Spur loam, 10 to 30 percent slopes; 17 percent is Agassiz rocky silt loam, 6 to 30 percent slopes; and 3 percent is included soils.

The Lucky Star soil is strongly sloping to steep. It is similar to Lucky Star gravelly silt loam, 30 to 60 percent slopes, except that it is less sloping and its surface layer is essentially free of gravel. The vegetation is aspen.

The Red Spur soil is moderately steep to steep. It is described under the Red Spur series. The vegetation is aspen and grass or shrubs and grass. The Agassiz soil is on spur ridges, where the vegetation is shrubs and grass.

Included in mapping were areas of Cluff silt loam, 6 to 30 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Capability unit VIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Lucky Star-Scout association (6 to 40 percent slopes) (LXE).—This mapping unit is on mountains, mostly north and east of Strawberry Valley. The exposures are mostly northern, but there are spur ridges that have eastern and western exposures. About 65 percent of the association is Lucky Star silt loam, 6 to 30 percent slopes; 25 percent is Scout gravelly loam, 10 to 40 percent slopes; and about 10 percent is included soils.

The Lucky Star soil has slopes that face east and west. It is similar to Lucky Star gravelly silt loam, 30 to 60 percent slopes, except that it is less sloping and its surface layer is essentially free of gravel and cobblestones. The vegetation is aspen.

The Scout soil has slopes that face north. On these slopes the vegetation is conifers.

Included in mapping were areas of St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes, on eastern and western exposures. Here, the vegetation is brush and grass.

Soils in this mapping unit are used for range, watershed, wildlife habitat, and woodland. (Lucky Star soil is in capability unit VIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Scout soil is in capability unit VIe-HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4)

Maughan Series

The Maughan series consists of well-drained soils that have a cobbly clay subsoil. These soils formed in residuum and colluvium derived from sandstone, shale, and limestone rocks. They are on north- and east-facing mountain slopes at elevations of 5,100 to 7,000 feet. Slopes range from 30 to 60 percent. The vegetation is bigtooth maple and an understory of slender wheatgrass, mountain brome, chokecherry, and scrubby aspen. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 42° to 45° F., and the frost-free season is 100 to 110 days. Maughan soils are associated with Datwyler, Elzinga, Sheep Creek, and Agassiz soils.

In a representative profile, the surface layer is very dark brown and very dark grayish-brown, neutral and slightly acid silt loam about 25 inches thick. The subsurface layer is light-brown, slightly acid, gravelly silt loam about 7 inches thick. The subsoil is reddish-brown cobbly clay and cobbly heavy clay loam to a depth of 66 inches or more.

Representative profile of Maughan silt loam, 30 to 60 percent slopes, in an area of Datwyler-Elzinga-Maughan complex, 30 to 60 percent slopes, 2 miles south and 1 mile west of Sterling crossroads, 500 feet north and 1,200 feet east of the southwest corner of sec. 22, T. 10 N., R. 1 W.:

A11—0 to 8 inches, very dark brown (10YR 2/2) light silt loam, black (10YR 2/1) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many fine, medium, and large roots; 10 percent gravel; neutral; gradual, smooth boundary.

A12—8 to 25 inches, very dark grayish-brown (10YR 3/2) silt loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium roots and few large roots; few, fine, interstitial pores; 10 percent gravel; slightly acid; clear, wavy boundary.

A2—25 to 32 inches, light-brown (7.5YR 6/4) gravelly silt loam, dark brown to brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; common fine and medium roots; many, fine and medium, interstitial and tubular pores; 20 percent gravel; slightly acid; clear, smooth boundary.

B21t—32 to 38 inches, reddish-brown (5YR 5/4) cobbly heavy clay loam, reddish brown (5YR 4/4) when moist; moderate, medium, prismatic structure; very hard, very firm, sticky and plastic; common fine and few medium roots; common, fine and medium, interstitial pores; common, thin, continuous clay films in pores; 30 percent gravel and cobblestones; medium acid; gradual, smooth boundary.

B22t—38 to 50 inches, reddish-brown (5YR 5/4) cobbly clay, reddish brown (5YR 4/4) when moist; moderate, medium, prismatic structure; extremely hard, extremely firm, sticky and very plastic; common fine roots; common, fine, interstitial pores; 30 percent gravel and cobblestones; common, moderately thick, continuous clay films on ped faces; slightly acid; gradual, smooth boundary.

B23t—50 to 66 inches, reddish-brown (5YR 5/4) cobbly light clay, reddish brown (5YR 4/4) when moist; weak, medium, prismatic structure; very hard, very firm, sticky and plastic; few fine roots; common, fine, interstitial pores; 30 percent weathering limestone cobblestones; common thin clay films in pores and some ped faces; neutral.

The A1 horizon ranges from 20 to 42 inches in thickness. The content of cobblestones and gravel ranges from 0 to 15 percent in the A1 horizon and from 20 to 35 percent in the A2 and B2t horizons. The A1 horizon ranges from very dark brown to dark gray. Reaction ranges from medium acid to neutral. Texture in the A2 horizon is gravelly light silt loam to gravelly heavy loam. Reaction in the A2 horizon is medium acid to slightly acid. The B2t horizon has hues of 7.5YR to 2.5YR. Texture in the B2t horizon ranges from cobbly clay or cobbly silty clay to cobbly heavy clay loam that is more than 35 percent clay. Reaction is medium acid to slightly acid. Thickness ranges from 20 to 40 inches or more.

Permeability is moderately slow to slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. These soils hold 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Maughan soils are used for range, watershed, and wildlife habitat.

Maughan-Datwyler association (30 to 60 percent slopes) (MAG).—This mapping unit is on the north end of the Wellsville Mountains. About 70 percent of the association is Maughan silt loam, 30 to 60 percent slopes, and about 30 percent is Datwyler cobbly silty clay loam, 30 to 60 percent slopes.

The Maughan soil has slopes that face north and east. The vegetation is maple and chokecherry and an understory of grasses and forbs.

The Datwyler soil is on ridges and has south-facing slopes. The vegetation is grass, shrubs, and forbs. In these areas the surface layer ranges from cobbly silty clay loam to gravelly loam.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Maughan soil is in capability unit VIIe-MN, nonirrigated; Mountain Loam (Shrubs) range site. Datwyler soil is in capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site; neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

McMurdie Series

The McMurdie series consists of well-drained soils that formed in mixed lake sediment derived dominantly from limestone, sandstone, and quartzite. These soils are on high lake terraces at elevations of 4,800 to 5,150 feet. Slopes range from 0 to 20 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, cheatgrass, balsamroot, and big sagebrush. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 130 to 150 days. McMurdie soils are associated with Parleys, Hillfield, Nebeker, Timpanogos, and Ricks soils.

In a representative profile (fig. 5), the surface layer is dark grayish-brown, neutral silt loam about 7 inches thick. The subsoil is dark grayish-brown, brown, and pale-brown, neutral silty clay loam and silty clay about 26 inches thick. The substratum is pale-brown, mildly alkaline, strongly calcareous loam and sandy loam to a depth of 60 inches or more.

McMurdie soils are used for irrigated crops and dry-farmed crops.

McMurdie silt loam, 3 to 6 percent slopes (McB).—This soil is on high lake terraces, mainly near the town of Paradise. Slopes are generally long.

Representative profile, 30 feet east of the northeast corner of Paradise Cemetery, 700 feet north of the southwest corner of the southeast quarter of sec. 27, T. 10 N., R. 1 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure and weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common fine roots; common fine pores; neutral; abrupt, smooth boundary.

B1—7 to 14 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; mod-

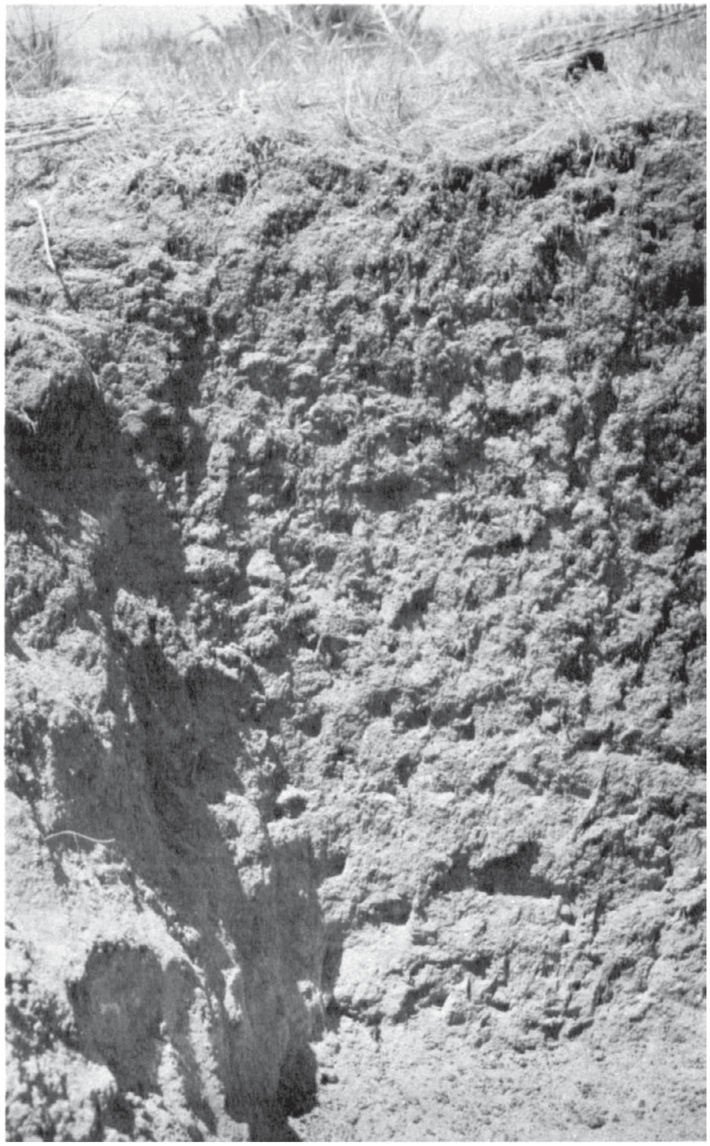

Figure 5.—Profile of McMurdie silt loam, 3 to 6 percent slopes.

erate, medium, subangular blocky structure that parts to moderate, fine, subangular blocky structure; very hard, firm, slightly sticky and plastic; common fine roots; many fine pores; few thin clay films; neutral; clear, wavy boundary.

B2t—14 to 33 inches, brown (7.5YR 5/2) silty clay, dark brown (7.5YR 3/2) when moist; strong, medium, prismatic structure that parts to strong, medium, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; common fine roots; common fine pores; common moderately thick clay films; neutral; clear, wavy boundary.

B3ca—33 to 43 inches, pale-brown (10YR 6/3) silty clay loam, brown (7.5YR 5/4) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; hard, firm, sticky and plastic; common fine roots; common fine and medium pores; few thin clay films; strongly calcareous; neutral; clear, wavy boundary.

C1ca—43 to 50 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; massive; hard, firm, sticky and plastic; few fine roots; common fine and medium pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

IIC2—50 to 60 inches, pale-brown; (10YR 6/3) sandy loam, brown (10YR 5/3) when moist; massive; soft, very friable, nonsticky and nonplastic; strongly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to brown or grayish brown. Texture ranges from silt loam to light silty clay loam. Thickness ranges from 7 to 12 inches. The B2t horizon ranges from brown to light brown in hues of 7.5YR and 10YR. Texture ranges from silty clay to heavy clay loam or heavy silty clay loam. Thickness ranges from 15 to 30 inches. The Cca and C horizons range from pale brown to brown or light brown in hues of 10YR and 7.5YR. Texture ranges from silty clay loam to sandy loam. Reaction is neutral to mildly alkaline, and the horizon is strongly calcareous. The ca horizon generally begins in the lower part of the B horizon.

Included in mapping were small areas of Hillfield silt loam. Also included were small areas of soils that have slopes of 1 to 3 percent and soils that have a silty clay loam surface layer.

This soil is fairly easy to till. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

This soil is used mostly for irrigated crops of alfalfa, small grain, and sugar beets. Some areas are used for dryfarmed crops. (Capability unit IIe–2, irrigated, IIe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

McMurdie silt loam, 0 to 3 percent slopes (McA).—This soil is on high lake terraces along the east side of Cache Valley. It is similar to McMurdie silt loam, 3 to 6 percent slopes, except that it is less sloping and its surface layer is 8 to 18 inches thick. Runoff is slow, and the hazard of erosion is none to slight.

This soil is used for irrigated crops. Alfalfa, small grain, sugar beets, peas, and corn for silage are common crops. (Capability unit IIc–2, irrigated, IIe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

McMurdie silt loam, 6 to 10 percent slopes (McC).—This soil is on high lake terraces. It is associated with McMurdie silt loam, 3 to 6 percent slopes, and is similar to that soil, except that it is more sloping. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Hillfield silt loam. Also included were small areas of soils that have slopes of slightly more than 10 percent.

This soil is used mainly for irrigated crops of alfalfa and small grain. Small areas are dryfarmed. (Capability unit IIIe–2, irrigated, IIIe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

McMurdie-Hillfield silt loams, 10 to 30 percent slopes, eroded (MdE2).—This complex consists of strongly undulating and rolling soils on high lake terrace escarpments east of the town of Paradise. About 60 percent of the complex is McMurdie silt loam, 10 to 20 percent slopes, and about 40 percent is Hillfield silt loam, 20 to 30 percent slopes, eroded. Runoff is rapid, and the hazard of erosion is high.

The McMurdie soil is on north-facing slopes or the lower part of south-facing slopes and in swales. It is similar to McMurdie silt loam, 3 to 6 percent slopes, except that it is more strongly sloping, it is moderately eroded, and the surface layer is 7 to 8 inches thick. In places tillage has exposed the subsoil.

The Hillfield soil is on convex ridges and the upper part of south-facing slopes.

Soils of this mapping unit are used for dryfarmed crops of alfalfa and winter wheat. (McMurdie soil is in capability unit IVe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3. Hillfield soil is in capability unit VIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Mendon Series

The Mendon series consists of well-drained soils that have a clay loam subsoil. These soils formed in alluvium and colluvium derived from light-colored tuff, conglomerate, tuffaceous sandstone, and limestone of the Salt Lake Formation. They are on lake terraces or rolling dissected foothills along the west side of Cache Valley and extend from the vicinity of Clarkston southward to Hyrum Reservoir. Elevations range from 4,500 to 5,100 feet, and slopes range from 0 to 20 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, balsamroot, and big sagebrush. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 150 days. Mendon soils are associated with Avon (fig. 6), Collinston, Wheelon, and Crookston soils.

In a representative profile (fig. 7), the surface layer is dark-gray, neutral silt loam about 7 inches thick. The subsoil is grayish-brown, neutral clay loam about 21 inches thick. The substratum is white and light brownish-gray, strongly calcareous, mildly alkaline loam to a depth of 60 inches or more.

Mendon soils are used mostly for dryfarming, but some areas are used for irrigated crops.

Mendon silt loam, 3 to 6 percent slopes (MeB).—This soil is on the gently undulating intermediate lake terraces. It is mainly along the west side of Cache Valley but also is on the east side between the towns of Richmond and Smithfield.

Representative profile, about 2 miles north and 1 mile west of Newton, 700 feet north and 40 feet west of the southeast corner of the southwest quarter of sec. 1, T. 13 N., R. 2 W.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; mixed weak, medium, subangular blocky and weak, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; few fine roots; few fine pores; neutral; abrupt, smooth boundary.

B2t—7 to 24 inches, grayish-brown (10YR 5/2) clay loam, very dark gray (10YR 3/1) when moist; moderate, medium, prismatic structure that parts to moderate,

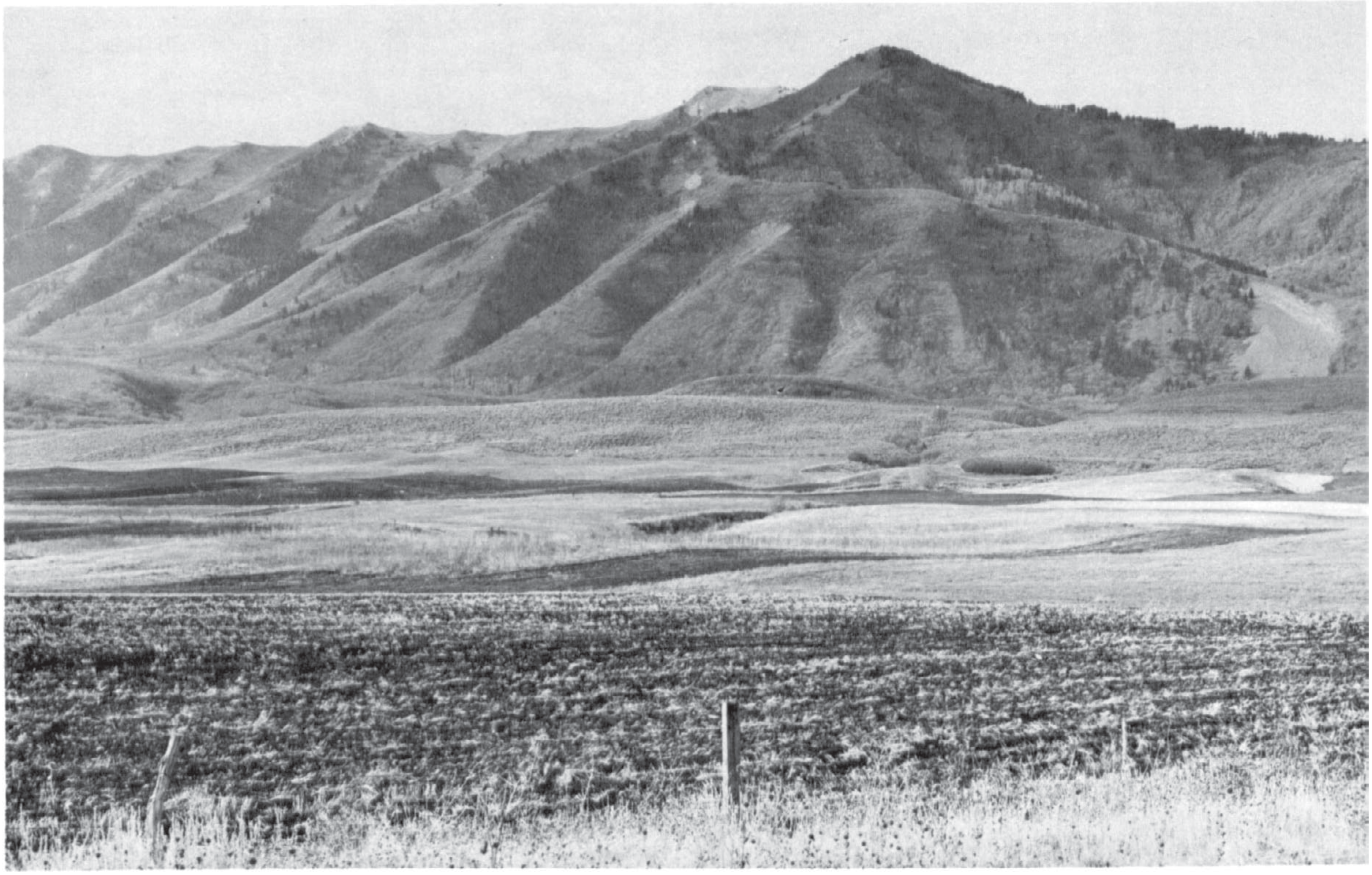

Figure 6.—Area of Mendon and Avon soils west of Mendon Cemetery. Collinston, Mendon, and Hiibner soils are on the upper lake terraces in the background, and Smarts and Lucky Star soils are dominant on the mountain.

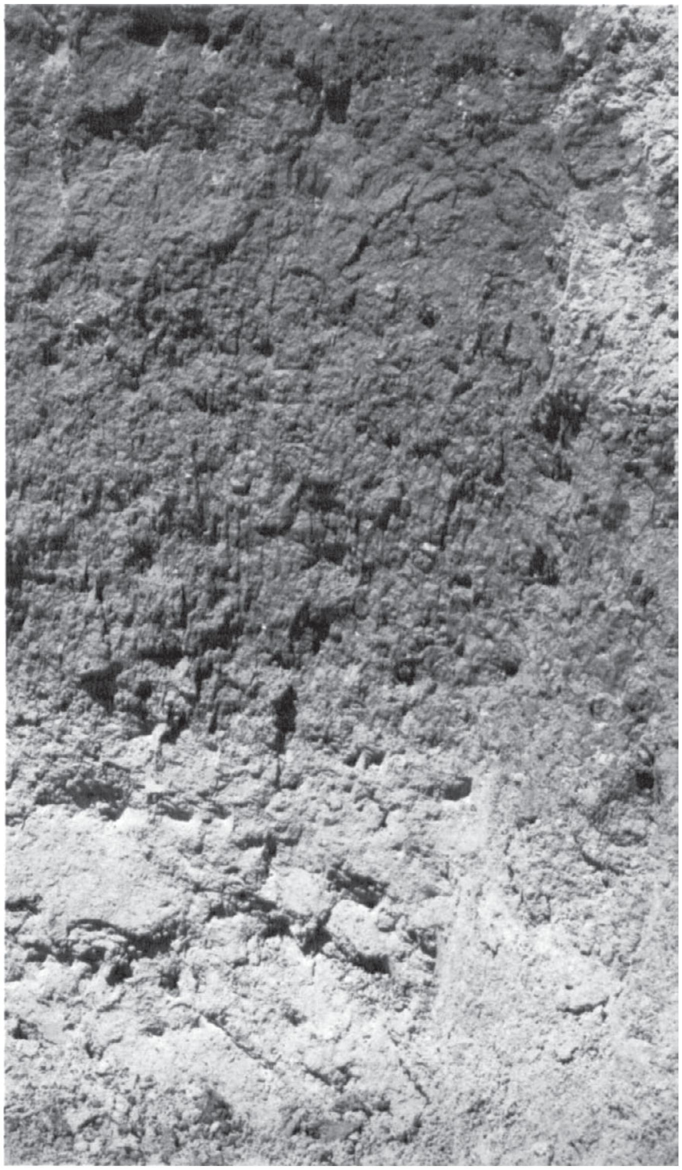

Figure 7.—**Profile of Mendon silt loam, 3 to 6 percent slopes.**

medium, subangular blocky structure; very hard, very firm, very sticky and plastic; common fine roots; many fine pores; common thin clay films; neutral; clear, smooth boundary.

B3ca—24 to 28 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; very hard, friable, sticky and plastic; common fine roots; few fine pores; few thin clay films; strongly calcareous; mildly alkaline; gradual, wavy boundary.

C1ca—28 to 34 inches, white (10YR 8/2) loam, pale brown (10 YR 6/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many fine and medium pores; very strongly calcareous; mildly alkaline; gradual, wavy boundary.

C2—34 to 40 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many fine, medium, and large pores; strongly calcareous; mildly alkaline; gradual, wavy boundary.

C3—40 to 60 inches, white (2.5Y 8/2) loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; no roots; common fine and medium pores; strongly calcareous; mildly alkaline.

The A horizon ranges from dark gray to very dark gray in a hue of 10YR or 2.5Y. Texture is dominantly silt loam but is light silty loam in places. Reaction is neutral to mildly alkaline, and the horizon generally is noncalcareous but is slightly calcareous in places because of recent deposition or rodent activity. Thickness ranges from 7 to 11 inches. The B2t horizon ranges from grayish brown to gray or dark grayish brown in a hue of 10YR or 2.5Y. Texture is clay loam to silty clay loam. Reaction is neutral to mildly alkaline. Thickness ranges from 8 to 18 inches. The C horizon ranges from white to light brownish gray or pale brown in a hue of 2.5Y or 10YR. Texture ranges from silt loam or loam to silty clay loam.

This soil is easy to till. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet.

Included in mapping were small areas of Collinston silt loam, 1 to 6 percent slopes, and small areas of Wheelon silt loam. Also included were few small areas of gravelly loam on ridges, particularly in the Newton and North Clarkston area.

This soil is used mainly for dryfarmed crops of alfalfa, winter wheat, and safflower. Small areas are irrigated. Alfalfa, small grain, and sugar beets are grown. (Capability unit IIe-2, irrigated, IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Mendon silt loam, 0 to 3 percent slopes (MeA).—This slightly undulating soil is on medium lake terraces. Except for slope, it is similar to Mendon silt loam, 3 to 6 percent slopes. The surface layer is 10 to 17 inches thick. Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for dryfarmed crops of alfalfa, winter wheat, and safflower. Small areas are irrigated. Sugar beets, alfalfa, and small grain are grown in these areas. (Capability unit IIc-2, irrigated; IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Mendon silt loam, 6 to 10 percent slopes (MeC).—This soil is on medium and high terraces. It is similar to Mendon silt loam, 3 to 6 percent slopes, except that it is more sloping and its surface layer is 7 to 10 inches thick. In places tillage has exposed the subsoil. Strong lime horizons are present at a depth of 20 to 24 inches. Runoff is medium, and the hazard of erosion is moderate. Most runoff is during intense thunderstorms or when snow melts exceptionally fast.

Included in mapping were small areas of Wheelon silt loam and small areas of gravelly soils.

This soil is used mostly for dryfarmed crops of alfalfa, alfalfa-grass mixture, winter wheat, and safflower. Small areas are sprinkler irrigated. (Capability unit IIIe-2, irrigated; IIIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Mendon-Collinston complex, 1 to 6 percent slopes (MfB).—This complex consists of strongly undulating soils on medium and high lake terraces along the west side of Cache Valley. About 45 percent of the complex is Mendon silt loam, 3 to 6 percent slopes; 45 percent is **Collins-**

ton loam, 1 to 6 percent slopes; and about 10 percent is included soils.

The Mendon soil is more gently sloping than the Collinston soil and commonly has slopes that face north. It is similar to Mendon silt loam, 3 to 6 percent slopes, except that the surface layer is 6 to 17 inches thick and is slightly calcareous in places. It is calcareous because of the deposition of calcareous material eroded from adjacent Collinston and Wheelon soils.

The Collinston soil has south- and east-facing slopes.

Included in mapping were areas of Wheelon silt loam that are on convex ridges and the steeper slopes of the complex. Also included were small areas of soils that have slopes of 6 to 15 percent and small gravelly areas that are associated with the Wheelon soil on the ridgetops.

Soils of this mapping unit are used for dryfarmed crops. Winter wheat (fig. 8) and alfalfa are common crops. (Capability unit IIIe-U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Mendon-Collinston complex, 6 to 30 percent slopes, eroded (MfE2).—This complex consists of strongly undulating or rolling soils on high lake terraces along the west side of Cache Valley. About 40 percent of the complex is Mendon silt loam, 6 to 10 percent slopes; 40 percent is Collinston loam, 10 to 30 percent slopes, eroded; and 20 percent is Wheelon silt loam, 10 to 30 percent slopes, eroded.

The Mendon soil generally is at the base of north-facing slopes and in depressions. It is similar to Mendon silt loam, 3 to 6 percent slopes, except that it is more sloping and its surface layer is slightly calcareous in places.

The Collinston soil generally is on moderately steep south-facing slopes and the upper part of north-facing slopes. It is similar to Collinston loam, 6 to 10 percent slopes, described under the Collinston series, except that it is steeper and is moderately eroded.

The Wheelon soil is on moderately steep, convex slopes and ridgetops.

Included in mapping were areas of soils that have a silty clay loam surface layer.

Soils of this mapping unit are used mostly for dryfarmed crops of winter wheat, alfalfa, and safflower. (Capability unit VIe-U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

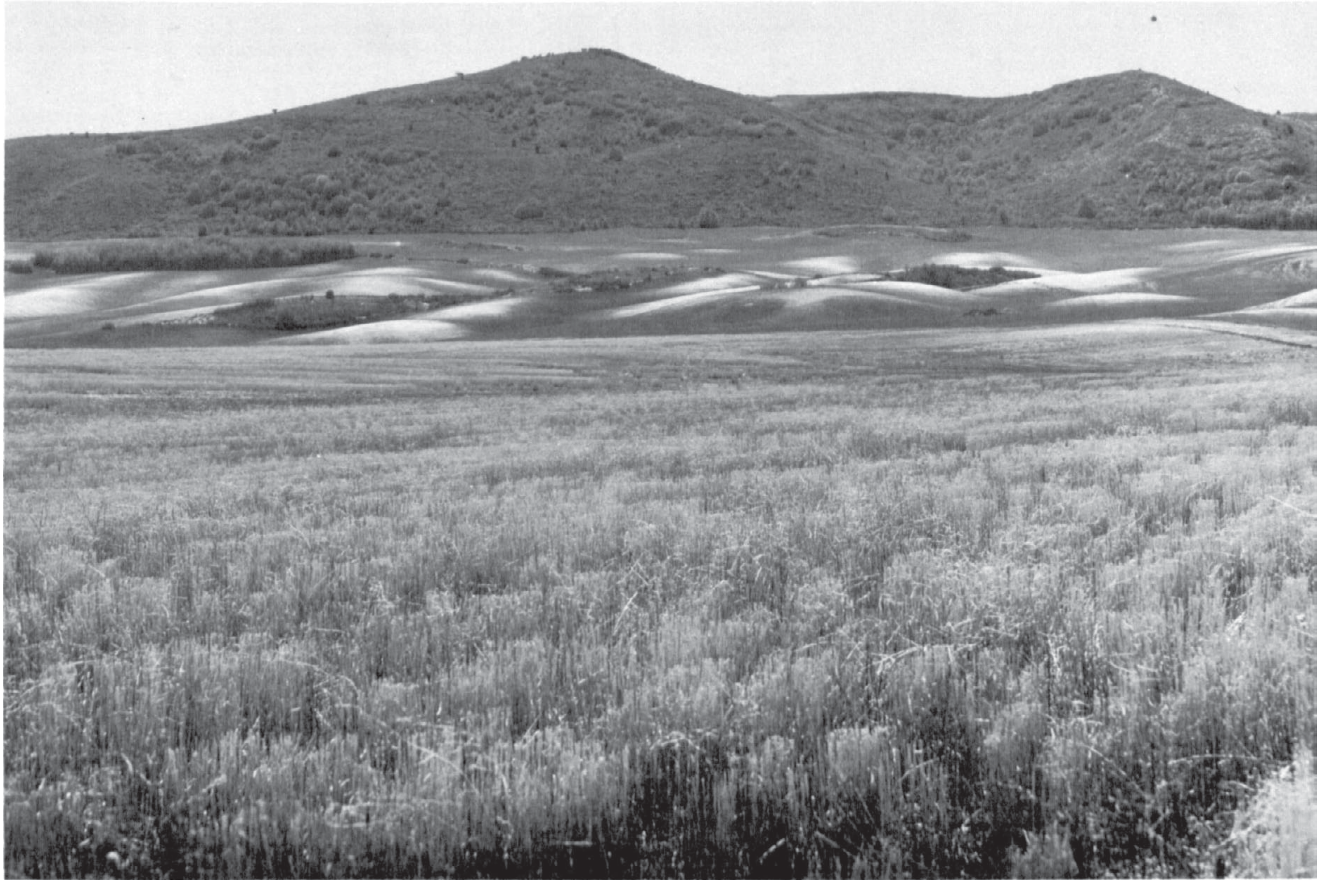

Figure 8.—Wheat stubble on the Mendon soil of the Mendon-Collinston complex, 1 to 6 percent slopes. Soils of the Mendon-Collinston complex, 6 to 30 percent slopes, eroded, are on the high lake terraces in the background.

Middle Series

The Middle series consists of well-drained, cobbly soils. The depth to bedrock ranges from 24 to 40 inches. These soils formed in residuum and colluvium derived from limestone, quartzite, and sandstone. They are on west- and south-facing mountain slopes at elevations of 5,000 to 6,500 feet. The slopes range from 30 to 70 percent. The vegetation is big sagebrush, low sagebrush, yellowbrush, bitterbrush, slender wheatgrass, bluebunch wheatgrass, prairie junegrass, and scattered juniper. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 110 to 130 days. Middle soils are associated with Richmond soils.

In a representative profile, the surface layer is grayish-brown, mildly alkaline cobbly light loam about 7 inches thick. The subsoil is brown and light yellowish-brown, mildly alkaline and moderately alkaline cobbly loam and very cobbly loam about 13 inches thick. The substratum is pink and light-brown, moderately alkaline very cobbly heavy sandy loam about 8 inches thick over limestone bedrock.

Representative profile of Middle cobbly loam, 30 to 70 percent slopes, in an area of Richmond-Middle association, eroded, in Box Elder County, on the west face of Wellsville Mountain, Cache National Forest, in the northeast quarter of the southwest quarter of the northeast quarter of sec. 9, T. 11 N., R. 2 W.:

A1—0 to 7 inches, grayish-brown (10YR 5/2) cobbly light loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure that parts to weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many micro and very fine roots and common fine roots; 30 percent channery limestone, cobblestones 3 to 6 inches in length; mildly alkaline; clear, wavy boundary.

B21—7 to 15 inches, brown (10YR 5/3) cobbly loam, dark brown to brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure that parts to moderate, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few thin clay films; common fine and very fine roots; few very fine pores; 40 percent angular cobblestones and 10 percent angular gravel; slightly calcareous; mildly alkaline; clear, wavy boundary.

B22—15 to 20 inches, light yellowish-brown (10YR 6/4) very cobbly loam, dark brown to brown (10YR 4/3) when moist; moderate, coarse, subangular blocky structure that parts to moderate, medium and fine, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common thin clay films on ped faces and in pores; 50 percent angular gravel; moderately calcareous; moderately alkaline; abrupt, wavy boundary.

Cca—20 to 28 inches, pink and light-brown (7.5YR 7/4 and 6/4) very cobbly heavy sandy loam, strong brown (7.5YR 4/6) when moist; weak, fine, subangular blocky structure that parts to weak, very fine, subangular blocky structure and single grain; slightly hard, very friable, nonsticky and nonplastic; few fine roots; 60 percent angular cobblestones; strongly calcareous; moderately alkaline.

R—28 inches, limestone rock.

The thickness of the solum and the depth to horizons of carbonate accumulation range from 16 to 28 inches. Coarse fragments range from 20 to 50 percent gravel and cobblestones in the A horizon, 40 to 80 percent cobblestones, gravel, and stones in the B2t horizon, and 50 to 90 percent cobblestones and stones in the C horizon. Coarse fragments are angular sandstone, limestone, and quartzite rock fragments. The A horizon ranges from grayish brown to brown. Texture is gravelly loam or cobbly loam. Reaction ranges from neutral to moderately alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness ranges from 7 to 12 inches. The B2 horizon ranges from brown to pale brown or grayish brown. Texture is very gravelly loam or cobbly loam to very cobbly loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is noncalcareous to moderately calcareous. The C horizon ranges from pink to brown or grayish brown in hues of 10YR and 7.5YR Texture ranges from very cobbly sandy loam to heavy loam. The matrix of the C horizon is moderately calcareous to strongly calcareous and has lime enrichment in the upper part. The calcium carbonate equivalent ranges from 4 to 40 percent.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. These soils hold 3 to 4 inches of available water above the bedrock. Roots generally extend to the bedrock, but some roots extend into cracks in the bedrock.

Middle soils are used for watershed, range, and wildlife habitat.

In the Cache Area, the Middle soils are mapped only in an association with the Richmond soils.

Millville Series

The Millville series consists of well drained and moderately well drained, very strongly calcareous soils. These soils formed in alluvium derived from dolomitic limestone. They are on alluvial fans deposited on high and medium lake terraces between the towns of Smithfield and Providence at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 6 percent. The vegetation is big sagebrush, bluebunch wheatgrass, bluegrass, cheatgrass, and gumweed. The average annual precipitation ranges from 15 to 17 inches, the mean annual temperature is 47° to 49° F., and the frost-free season is 140 to 160 days. Millville soils are associated with Green Canyon, Timpanogos, Parleys, Greenson, and Nibley soils.

In a representative profile, the surface layer is dark grayish-brown and grayish-brown silt loam about 12 inches thick. This is underlain by light brownish-gray, pale-brown, and light-gray silt loam that extends to a depth of 60 inches or more. The entire profile is moderately alkaline and very strongly calcareous.

Millville soils are used mainly for irrigated crops.

Millville silt loam, 2 to 4 percent slopes (MlB).—This soil is on alluvial fans, chiefly in the North Logan-Smithfield area.

Representative profile in a cultivated area, one-fourth mile north of the Utah State University Dairy Farm Headquarters, 40 feet north and 100 feet west of the northeast corner of the southeast quarter of sec. 22, T. 12 N., R. 1 E.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; few medium pores; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

A12—6 to 12 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; very weak, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine roots; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

AC—12 to 24 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C1—24 to 35 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C2—35 to 65 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; very strongly calcareous; moderately alkaline.

The A1 horizon ranges from dark grayish brown to brown in a hue of 10YR. Reaction is moderately alkaline to mildly alkaline, and the horizon is strongly calcareous or very strongly calcareous. Thickness ranges from 7 to 15 inches. The C horizon ranges from pale brown to light gray or light brownish gray in a hue of 10YR or 2.5Y.

This soil is easy to till. It is well drained, and permeability is moderate. Runoff is slow, and the hazard of erosion is slight. This soil holds 8 to 10 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet or more.

Included in mapping were small areas of Green Canyon gravelly loam, 0 to 3 percent slopes, and areas of slightly steeper soils. Also included are small areas of moderately well drained Millville soils.

This soil is used mostly for irrigated crops of alfalfa, sugar beets, small grains, peas, pole beans, and corn for silage. (Capability unit IIe–2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Millville silt loam, 0 to 2 percent slopes (MlA).—This soil is similar to Millville silt loam, 2 to 4 percent slopes, except that it is more gently sloping and has a fluctuating water table between depths of 40 and 50 inches during the growing season. It is moderately well drained. Strong-brown to light olive-brown mottles are present in the lower subsoil and substratum.

Included in mapping were small gravelly areas and small areas of a silty clay loam.

This Millville soil is used for irrigated crops of alfalfa, small grain, sugar beets, peas, pole beans, and corn for silage. (Capability unit IIw–2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Mixed Alluvial Land

Mixed alluvial land (Mm) is a miscellaneous land type consisting of stratified, dominantly sandy alluvial soil material deposited along the flood plain of the Bear River, Blacksmith Fork River, and other streams. The area is characterized by many oxbows and wet spots. It is subject to overflow during periods of high runoff in spring. Little or no profile formation has taken place, but mottling is evident in the substratum. Grass, weeds, and willows are established in some places, and the area has limited use for grazing. The principal use is for wildlife habitat. (Capability unit Vw–2, nonirrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Mult Series

The Mult series consists of well-drained soils. Fractured limestone bedrock is at a depth of 22 to 40 inches. These soils formed in colluvium and residuum derived dominantly from limestone. They are on north- and east-facing mountain slopes at elevations of 6,800 to 9,500 feet. Slopes range from 6 to 50 percent. The vegetation is aspen and scattered conifers and an understory of snowberry, slender wheatgrass, mountain brome, and blue wildrye. The average annual precipitation ranges from 25 to 30 inches, the average annual air temperature is 36° to 42° F., and the frost-free season is 70 to 90 days. Mult soils are associated with Bickmore, Lucky Star, Dateman, Agassiz, and Elwood soils.

In a representative profile, the surface layer is brown, slightly acid and medium acid heavy silt loam, about 14 inches thick, that has a moderate to moderately high organic-matter content. The subsoil is yellowish-brown, medium acid silty clay loam about 10 inches thick. Fractured limestone bedrock is at a depth of about 24 inches. Carbonates have been leached from the surface layer and subsoil. The base saturation percentage ranges from 70 to 85 percent.

Mult soils are used for watershed, wildlife habitat, woodland, and range.

Mult-Agassiz association (MNE).—This mapping unit is in the upper areas of LaPlatta Creek, Davenport Creek, and South Cottonwood. The soils are on mountain slopes that have many side drainageways. The exposed rock formations are limestone. About 40 percent of the association is Mult silt loam, 6 to 30 percent slopes; 40 percent is Agassiz rocky silt loam, 6 to 30 percent slopes; and 20 percent is Elwood silt loam, 10 to 30 percent slopes.

The Multi soil is predominantly on north-facing slopes in basinlike pockets where the vegetation is aspen. The Agassiz soil is on south-, east-, and west-facing slopes of ridges. Here, the vegetation is shrubs, grass, and a few coniferous trees. The Elwood soil has north- and east-facing slopes. Depth to bedrock ranges from 22 to 40 inches. The vegetation is Douglas-fir and alpine fir.

Representative profile of Mult silt loam, 6 to 20 percent slopes, in an area of Mult-Agassiz association in South Cottonwood Canyon, 1,600 feet south and 1,200 feet east of the northwest corner of sec. 30, T. 10 N., R. 3 E.:

A11—0 to 4 inches, brown (10YR 4/3) heavy silt loam, very dark brown (10YR 2/3) when moist; moderate, fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine roots and common medium roots; slightly acid; abrupt, wavy boundary.

A12—4 to 14 inches, brown (10YR 4/3) heavy silt loam, dark brown (10YR 3/3) when moist; strong, medium and coarse, granular structure; slightly hard, friable, slightly sticky and plastic; many fine roots and common medium roots; common, very fine, discontinuous, random, inped and exped, interstitial and tubular pores; medium acid; clear, smooth boundary.

B21t—14 to 24 inches, light yellowish-brown (10YR 6/4) silty clay loam, dark brown to brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, firm, sticky and plastic; common, very fine, discontinuous, random, inped and exped, interstitial and tubular pores; common fine and medium roots; thin continuous clay films on peds and moderately thick continuous clay films in pores;

tongues of A12 material extend through this horizon; medium acid; clear, broken boundary.

R—24 inches, fractured limestone rock.

The A1 horizon ranges from brown to grayish brown in hues of 10YR and 7.5YR. Texture ranges from silt loam or loam to light silty clay loam. Thickness ranges from 8 to 16 inches. The B2t horizon ranges from yellowish brown or light brown to brown or reddish brown in hues of 10YR to 5YR. Texture ranges from silty clay loam or clay loam to heavy silt loam. Reaction ranges from medium acid to mildly alkaline. The lower part of the B2t horizon is slightly calcareous in places.

Permeability of the Mult soil is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 5 to 7 inches of available water above the bedrock. Roots are mostly in the surface 20 to 40 inches above the bedrock. Some roots extend into cracks in the bedrock.

Soils of this mapping unit are used for range, watershed, wildlife habitat, and woodland. (Mult soil is in capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Mult-Agassiz association, eroded (30 to 70 percent slopes) (MNG2).—This mapping unit is east of the Logan River in the Franklin Basin area. The soils are on southwest-facing mountain slopes that are dissected somewhat by canyons and drainages. The elevation ranges from 6,500 to 7,200 feet. About 50 percent of the association is Mult silt loam, 30 to 50 percent slopes; 45 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and about 5 percent is included soils.

The Mult soil generally has concave slopes that face east. This soil is similar to Mult silt loam, 6 to 30 percent slopes, except that it has slopes of 30 to 50 percent. The surface layer ranges from 11 to 14 inches in thickness, and the depth to bedrock ranges from 30 to 40 inches. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The vegetation is aspen.

The rocky Agassiz soil has slopes that face south and west. The vegetation is big sagebrush and curlleaf mountain-mahogany.

Included in mapping were areas of Elwood silt loam, 30 to 60 percent slopes. This soil generally has an easterly exposure. The vegetation is Douglas-fir and alpine fir.

Soils of this mapping unit are used for range, watershed, wildlife habitat, and woodland. (Mult soil is in capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Mult-Lucky Star association (6 to 30 percent slopes) (MSE).—This mapping unit consists of soils on mountain slopes in the upper LaPlatta Creek area. About 35 percent of the association is Mult silt loam, 6 to 30 percent slopes; 30 percent is Lucky Star silt loam, 6 to 30 percent slopes; 30 percent is Agassiz rocky silt loam, 6 to 30 percent slopes; and about 5 percent is included soils.

The Mult and Lucky Star soils are on all exposures. The vegetation is aspen. The Agassiz soil is on east-, south-, and west-facing ridges. The vegetation is sagebrush.

Soils of this mapping unit are used for range, watershed, wildlife habitat, and woodland. (Mult and Lucky Star soils are in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Munk Series

The Munk series consists of well-drained soils that formed in light-colored tuff, tuffaceous sandstone, and limestone. Depth to bedrock is 20 to 40 inches. These soils are on mountain slopes, mainly along the west side of Cache Valley at elevations of 4,500 to 5,700 feet. Slopes range from 30 to 70 percent. The vegetation is bluebunch wheatgrass, sagebrush, yellowbrush, oyster plant, and bitterbrush. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the average frost-free season is 120 to 140 days. Munk soils are associated with Blackrock, Collinston, and Wheelon soils.

In a representative profile, the surface layer is grayish-brown, moderately alkaline gravelly loam about 8 inches thick. The next layer is light brownish-gray, moderately alkaline very gravelly loam about 15 inches thick. The substratum is white, very strongly calcareous, strongly alkaline very gravelly sandy loam that is underlain by bedrock at a depth of about 36 inches.

Munk soils are used for range, watershed, and wildlife habitat.

Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded (MoG2).—This complex is on mountain slopes along the west side of Cache Valley. About 60 percent of the complex is Munk gravelly loam, 30 to 70 percent slopes, eroded; and 40 percent is Blackrock gravelly loam, 30 to 60 percent slopes.

The Munk soil is on south- and west-facing side slopes and ridges. It is moderately eroded.

The Blackrock soil has slopes that face north and east.

Representative profile of Munk gravelly loam in an area of Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded, in a range area, approximately 600 feet south and 200 feet west of the northeast corner of the southeast quarter of sec. 7, T. 14 N., R. 1 W.:

A1—0 to 8 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; common fine pores; 40 percent gravel; moderately calcareous; moderately alkaline; clear, smooth boundary.

AC—8 to 23 inches, light brownish-gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; common fine pores; 50 percent gravel; strongly calcareous; moderately alkaline; abrupt, smooth boundary.

Cca—23 to 36 inches, white (10YR 8/2) very gravelly sandy loam, light brownish gray (10YR 6/2) when moist; massive; soft, very friable, nonsticky and nonplastic;

few fine roots; approximately 50 to 60 percent gravel; very strongly calcareous; strongly alkaline; abrupt, smooth boundary.

R—36 inches, partially consolidated bedrock (Salt Lake Geologic Formation material).

The A1 horizon ranges from grayish brown to brown, dark brown, or light olive brown in a hue of 10YR or 2.5Y. Texture is gravelly loam to gravelly silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. Thickness ranges from 7 to 10 inches. The transitional AC horizon ranges from light brownish gray to brown, pale brown, or light yellowish brown in a hue of 10YR or 2.5Y. Texture is very gravelly loam to gravelly loam or very gravelly silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is strongly calcareous to moderately calcareous. Thickness ranges from 6 to 15 inches. The Cca and C horizons range from white to light yellowish-brown in hues of 10YR and 2.5Y. Texture ranges from very gravelly sandy loam to very gravelly loam. Reaction is moderately alkaline to strongly alkaline, and the horizon is strongly calcareous to very strongly calcareous. In places 10 percent cobblestones are on the surface and throughout the profile. The depth to bedrock ranges from 20 to 40 inches. In places the ca horizon is weakly to moderately cemented. Coarse fragments are mostly gravel- and cobblestone-size, rounded to slightly angular limestone rock fragments and range in volume from 20 to 50 percent in the A1 horizon and from 50 to 70 percent in the Cca and C horizons.

Permeability is moderate. Runoff is rapid or very rapid, and the hazard of erosion is high to very high. The available water holding capacity is 2 to 4 inches above bedrock.

Included in mapping were a few areas of deep and moderately deep, light-colored loamy soils and small areas of limestone rock outcrops.

These soils are used for range. Erosion control and proper range use are the principal management needs. (Munk soil is in capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2. Blackrock soil is in capability unit VIIs–U4; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Nebeker Series

The Nebeker series consists of well-drained soils that have a clay subsoil. These soils formed in noncalcareous alluvium derived from sandstone, quartzite, and shale. They are on coalescing alluvial fans at elevations of 5,100 to 5,700 feet. Slopes range from 3 to 40 percent. The vegetation is slender wheatgrass, western wheatgrass, big sagebrush, bitterbrush, and mulesear dock. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 110 to 140 days. Nebeker soils are associated with McMurdie, Hiibner, Parleys, Richmond, and Hendricks soils.

In a representative profile, the surface layer is dark grayish-brown, slightly acid silt loam, about 8 inches thick, that has a moderately high organic-matter content. The subsoil is brown, slightly acid silt loam and silty clay loam about 47 inches thick. The substratum is brown, mildly alkaline clay loam to a depth of 60 inches or more.

Nebeker soils are used for dryfarmed crops, irrigated crops, and range.

Nebeker silt loam, 10 to 25 percent slopes (NbE).—This soil is on old fans just above the highest level of ancient Lake Bonneville.

Representative profile in a cultivated area, 1 mile north and 1½ miles east of Paradise, 20 feet north and 100 feet west of the southeast corner of the southwest quarter of sec. 14, T. 10 N., R. 1 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores and common medium pores; slightly acid; clear, wavy boundary.

B1—8 to 14 inches, brown (7.5YR 5/3) heavy silt loam, dark brown (7.5YR 3/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; hard, firm, sticky and plastic; common fine roots; common fine pores and few medium pores; few thin clay films; medium acid; clear, wavy boundary.

B21t—14 to 26 inches, brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, sticky and plastic; few fine roots; common fine pores; common thin clay films; slightly acid; abrupt, smooth boundary.

B22t—26 to 48 inches, brown (7.5YR 5/4) clay, reddish brown (5YR 4/3) when moist; strong, coarse, prismatic structure that parts to strong, coarse, subangular blocky structure; extremely firm, very sticky and very plastic; few fine roots; few fine pores; many thin clay films; slightly acid; clear, smooth boundary.

B23t—48 to 55 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, sticky and plastic; common fine pores; many moderately thick clay films; neutral; clear, smooth boundary.

IIC—55 to 70 inches, brown (10YR 5/3) clay loam, dark brown to brown (10YR 4/3) when moist; massive; slightly hard, firm, slightly sticky and plastic; slightly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to brown in a hue of 10YR or 7.5YR. Texture ranges from silt loam to light silty clay loam. Reaction ranges from medium acid to neutral. Thickness ranges from 3 to 10 inches. The B1 horizon ranges from brown to dark grayish brown in a hue of 7.5YR or 10YR. Texture ranges from heavy silt loam to silty clay loam. Reaction ranges from medium acid to neutral. Thickness ranges from 4 to 8 inches. The B2t horizon ranges from brown to reddish brown or light brown in a hue of 7.5YR or 5YR. Texture ranges from heavy clay loam or heavy silty clay loam to clay or silty clay. Reaction is slightly acid to neutral. Thickness ranges from 30 to 50 inches. The C horizon ranges from brown to yellowish brown or light brown in hues of 7.5YR and 10YR. Texture ranges from clay loam to light clay. Reaction is neutral to mildly alkaline, and the horizon is slightly calcareous to moderately calcareous.

Included in mapping were small areas of Hendricks silt loam, 10 to 20 percent slopes, and small areas of Sterling gravelly loam, 10 to 20 percent slopes. Also included were small areas of soils that have slopes of 25 to 30 percent.

This soil is fairly easy to till. Permeability is moderately slow. Runoff is medium, and the hazard of erosion is moderate. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Plant roots penetrate to a depth of 5 feet or more.

This soil is used mostly for dryfarmed crops. Principal crops are alfalfa and winter wheat. (Capability unit IVe–

M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Nebeker silt loam, 3 to 6 percent slopes (NbB).—This soil is on the lower part of old alluvial fans. Except for its more gentle slopes, it is similar to Nebeker silt loam, 10 to 25 percent slopes. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mostly for dryfarmed crops, but some areas are irrigated. The crops are small grain and alfalfa. (Capability unit IIe-2, irrigated, IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Nebeker silt loam, 6 to 10 percent slopes (NbC).—This soil is on fans. Except that it is less sloping, it is similar to Nebeker silt loam, 10 to 25 percent slopes. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Sterling gravelly loam, 6 to 10 percent slopes, and a few small areas of soils that have slopes of 10 to 20 percent.

This soil is used mostly for dryfarmed crops, but some areas are irrigated. Principal crops are alfalfa and small grain. (Capability unit IIIe-2, irrigated, IIIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Nibley Series

The Nibley series consists of somewhat poorly drained soils that formed in mixed lake sediment derived from limestone, sandstone, and quartzite. These soils are on medium and low lake terraces at elevations of 4,450 to 4,700 feet. Slopes range from 0 to 6 percent. The vegetation is foxtail, saltgrass, Kentucky bluegrass, wiregrass, and sedges. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 150 days. Nibley soils are associated with Collett, Greenson, Airport, and Parleys soils.

In a representative profile, the surface layer is dark grayish-brown, mildly alkaline heavy silty clay loam about 13 inches thick. The subsoil is brown and light-gray, mildly alkaline to moderately alkaline silty clay in the upper part and light-gray, strongly alkaline silty clay in the lower part. It is about 30 inches thick. The substratum is light-gray, moderately to strongly alkaline, strongly calcareous silty clay to a depth of 60 inches or more.

Nibley soils are used for irrigated crops and range.

Nibley silty clay loam, 0 to 3 percent slopes (NcA).—This soil is on broad, low lake terraces, generally east of College Ward and north of Hyrum.

Representative profile in a cultivated area, 1/8 mile south and 5/8 mile east of the Utah State University Animal Husbandry Farm Headquarters, 500 feet north and 300 feet east of the southwest corner of the northeast quarter of sec. 30, T. 11 N., R. 1 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) heavy silty clay loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; hard, firm, sticky and plastic; common fine roots and few medium roots; few fine pores; noncalcareous; mildly alkaline; abrupt, smooth boundary.

A1—7 to 13 inches, dark grayish-brown (10YR 4/2) heavy silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; hard, firm, sticky and plastic; common fine roots and few medium roots; common fine pores; noncalcareous; mildly alkaline; abrupt, smooth boundary.

B21t—13 to 20 inches, brown (10YR 5/3) silty clay, brown to dark brown (7.5YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; very hard, very firm, sticky and very plastic; common fine roots; common fine pores and few medium pores; common thin clay films; slightly calcareous; mildly alkaline; gradual, wavy boundary.

B22tca—20 to 32 inches, light-gray (10YR 7/2) silty clay, grayish brown (10YR 5/2) when moist; few, fine, distinct, strong brown (7.5YR 5/8) mottles; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; very hard, very firm, sticky and very plastic; few fine roots; many fine pores and few medium pores; few thin clay films; strongly calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—32 to 43 inches, light-gray (10YR 7/2) silty clay, pale brown (10YR 6/3) when moist; common, medium distinct, strong-brown (7.5YR 5/8) mottles; weak, medium, prismatic structure that parts to moderate, fine, subangular blocky structure; very hard, very firm, sticky and very plastic; few fine roots; many fine pores and few medium pores; strongly calcareous; strongly alkaline; clear, smooth boundary.

C—43 to 60 inches, light-gray (2.5Y 7/2) silty clay, light brownish gray (2.5Y 6/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; very hard, very firm, sticky and very plastic; common fine pores; strongly calcareous; moderately alkaline.

The A horizon ranges from dark grayish brown to grayish brown. Texture ranges from silty clay loam to heavy silt loam. Reaction is neutral to mildly alkaline. Thickness ranges from 6 to 15 inches. The B2t horizon ranges from brown to grayish brown in a hue of 10YR or 7.5YR. Texture ranges from heavy silty clay loam to silty clay. Reaction ranges from neutral to moderately alkaline. The B2tca and B3ca horizons range from light gray to light brown or very pale brown in hues of 10YR and 7.5YR. Texture ranges from silty clay to heavy silty clay loam. Reaction is moderately alkaline to strong alkaline. The C horizon ranges from light gray to white or very pale grown in a hue of 2.5Y, 10YR, or 7.5YR. Texture ranges from silt loam to silty clay. Reaction is moderately alkaline to strongly alkaline. The depth to the water table generally is 30 to 40 inches in undrained areas and is 50 inches to more than 60 inches in drained areas.

The soil is fairly difficult to till. Permeability is slow. Runoff is very slow to slow, and the hazard of erosion is none to slight. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Most plant roots are within a depth of 20 inches, but some penetrate to a depth of more than 5 feet.

Included in mapping were small areas of soils that are slightly affected by salt and alkali. Also included are a few small areas of Greenson loam, 0 to 3 percent slopes, and Collett silty clay loam.

This soil is mostly drained. It is used mainly for irrigated crops of alfalfa, small grain (fig. 9), sugar beets, and corn for silage. Some areas are in native pasture. (Capability unit IIIw-2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Nibley silty clay loam, 3 to 6 percent slopes (NcB).—This soil is in narrow bands and generally is at slightly higher elevations than Nibley silty clay loam, 0 to 3 percent slopes. Slopes are short. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

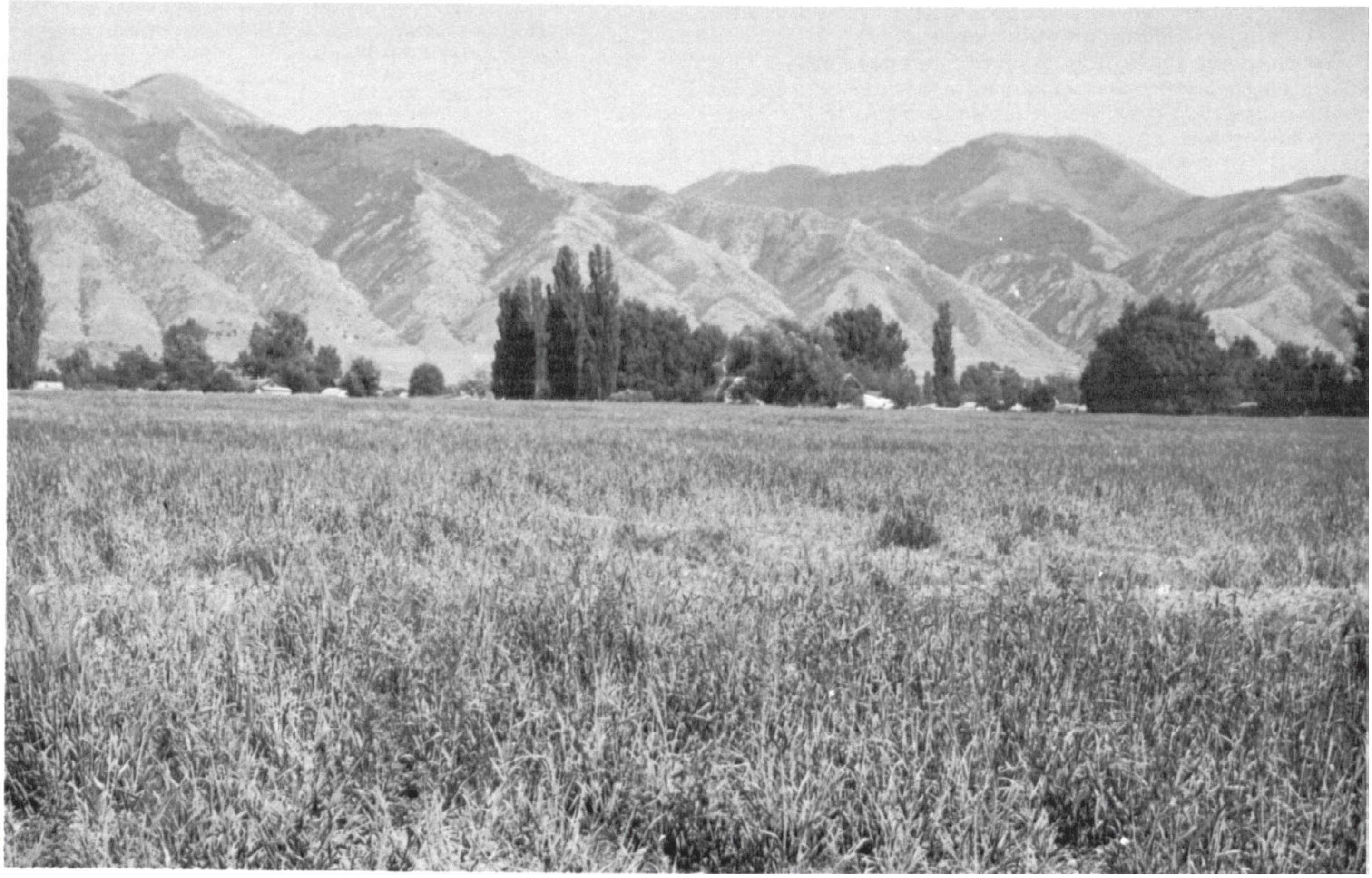

Figure 9.—**Barley growing on Nibley silty clay loam, 0 to 3 percent slopes. Wasatch Mountains are in the background.**

Included in mapping were small areas of gravelly loam soils and small areas of Greenson loam, 3 to 6 percent slopes.

This soil is used for irrigated crops of alfalfa, small grain, and sugar beets. (Capability unit IIIw–2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 1)

Obray Series

The Obray series consists of well-drained soils that formed in mixed colluvium and alluvium derived from limestone, quartzite, and sandstone. These soils are on alluvial and colluvial fans at elevations of 5,000 to 7,000 feet. Slopes range from 1 to 20 percent. The vegetation is Idaho fescue, slender wheatgrass, prairie junegrass, Great Basin wildrye, mulesear dock, yarrow, low sagebrush, and snowberry. The average annual precipitation ranges from 18 to 25 inches, the mean annual air temperature is 42° to 45° F., and the frost-free season is 60 to 100 days. Obray soils are associated with Nebeker, Goring, Hiibner, and Yeates Hollow soils.

In a representative profile, the soil is dark grayish-brown to pale-brown, slightly acid to mildly alkaline silty clay that extends to a depth of 60 inches or more.

Obray soils are used mostly as range. Some small areas are used for dryfarmed crops of alfalfa and small grain.

Obray silty clay, 1 to 6 percent slopes (ObB).—This soil is on the foot slopes of mountains in an area south of East Canyon and southeast of the town of Avon.

Representative profile in a cultivated area, about 4 miles south and 1 mile east of Avon, 900 feet west of the southeast corner of the northwest quarter of sec. 25, T. 9 N., R. 1 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine and medium, granular structure; very hard, firm, sticky and very plastic; few medium and fine roots; common fine pores; slightly acid; clear, smooth boundary.

A11—7 to 22 inches, brown to dark-brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores; common slickensides; slightly acid; gradual, wavy boundary.

A12—22 to 32 inches, brown (7.5YR 5/3) silty clay, dark brown (7.5YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores; common slickensides; neutral; clear, irregular boundary.

C1—32 to 39 inches, brown (7.5YR 5/4) silty clay, dark brown (7.5YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores; common slickensides; slightly calcareous; neutral; gradual, irregular boundary.

C2ca—39 to 52 inches, brown (7.5YR 5/4) silty clay, brown (7.5YR 5/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, very firm, sticky and very plastic; moderately calcareous; mildly alkaline; gradual, irregular boundary.

C3ca—52 to 60 inches, very pale brown (10YR 7/3) heavy silty clay loam, light yellowish brown (10YR 6/4) when moist; massive; hard, firm, sticky and plastic; strongly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to brown or dark brown. Reaction is slightly acid to medium acid. Slickensides are common to many. The C horizon ranges from brown to light brown or very pale brown. Texture ranges from silty clay or clay, to heavy silty clay loam or clay loam. Reaction ranges from medium acid to mildly alkaline, and the horizon is noncalcareous to strongly calcareous. The upper 30 inches of the profile is noncalcareous, but at depths between 30 to 65 inches, it ranges from noncalcareous to moderately calcareous. If the soils are dry, cracks ½ inch to 2 inches wide extend to a depth of 40 inches or more. In uncultivated areas, gilgai microrelief is evident.

Permeability is very slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 3 to 4 feet.

Included in mapping were small areas of stony silty clay soils on steep escarpments.

This soil is used for range. (Capability unit VIe-M5, nonirrigated; Mountain Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Parleys Series

The Parleys series consists of well-drained soils that have a clay loam subsoil. These soils formed in mixed lake sediment derived from limestone, sandstone, and quartzite. They are on medium and high lake terraces at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 10 percent. The vegetation is bluebunch wheatgrass, big sagebrush, gumweed, and balsamroot. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 120 to 160 days. Parleys soils are associated with Timpanogos, McMurdie, Battle Creek, and Hillfield soils.

In a representative profile, the surface layer is dark grayish-brown, neutral silt loam about 8 inches thick. The subsoil is neutral, dark grayish-brown loam, brown clay loam, and pale-brown silt loam about 28 inches thick. The substratum is light-brown, mildly alkaline, strongly calcareous silt loam to a depth of 60 inches or more.

Parleys soils are used for dryfarmed and irrigated crops.

Parleys silt loam, 0 to 3 percent slopes (PaA).—This level to slightly undulating soil is on slightly convex, medium and high lake terraces.

Representative profile in a cultivated area, 1½ miles south and 1¾ miles east of the city of Hyrum, 100 feet north and 900 feet west of the southeast corner of the northeast quarter of sec. 15, T. 10 N., R. 1 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, fine and medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; neutral; abrupt, smooth boundary.

B1—8 to 12 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure that parts to moderate, fine, angular blocky structure; very hard, firm, slightly sticky and plastic; common fine roots; common fine pores; thin patchy clay films, neutral; clear, wavy boundary.

B21t—12 to 19 inches, brown (7.5YR 5/4) clay loam, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, slightly sticky and plastic; common fine roots; many fine pores; thin continuous clay films; neutral; distinct, smooth boundary.

B22t—19 to 31 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; hard, firm, slightly sticky and plastic; few fine roots; many fine pores; thin continuous clay films; neutral; distinct, smooth boundary.

B3ca—31 to 36 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores and few medium pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C1ca—36 to 52 inches, light-brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine pores; strongly calcareous; mildly alkaline.

C2ca—52 to 68 inches, light-brown (7.5YR 6/4) silt loam, yellowish brown (10YR 5/4) when moist; few, medium, faint, strong-brown (7.5YR 5/6) mottles; massive; soft, very friable, slightly sticky and slightly plastic; strongly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to grayish brown. Texture ranges from silt loam to loam or light silty clay loam. Reaction is neutral to mildly alkaline. Thickness ranges from 7 to 18 inches. The B2t horizon ranges from brown to yellowish brown in a hue of 10YR or 7.5YR. Texture is silty clay loam to clay loam. The Cca and C horizons range from light brown to very pale brown or pale brown in a hue of 10YR or 7.5YR. Texture ranges from silt loam or loam to silty clay loam. Reaction is mildly alkaline to moderately alkaline.

This soil is easy to till. Permeability is moderately slow. Runoff is slow, and the hazard of erosion is none to slight. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more.

Included in mapping were small areas of Timpanogos silt loam, 0 to 3 percent slopes, and small areas of moderately well drained Parleys soils.

This soil is used for irrigated crops. Principal crops are alfalfa, small grain, sugar beets, peas, beans, and corn for silage. About 20 percent of the acreage is used for dryfarmed crops of alfalfa and small grain. (Capability unit IIc-2, irrigated, IIIe-U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parleys silt loam, 3 to 6 percent slopes (PaB).—This soil generally is on high lake terraces along the east side of Cache Valley, extending from Smithfield south to Paradise. Except for slope, it is similar to Parleys silt loam, 0 to 3 percent slopes. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Hillfield silt loam, 20 to 30 percent slopes, eroded.

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This Parleys soil is used for irrigated crops of alfalfa, small grain, sugar beets, peas, and beans. (Capability unit IIe-2, irrigated, IIIe-U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parleys silt loam, 6 to 10 percent slopes (PaC).—This soil is on high lake terraces along the east-central part of Cache Valley. Except that it is more sloping, it is similar to Parleys silt loam, 0 to 3 percent slopes. The surface layer is 7 to 12 inches thick. Depth to the strongly calcareous substratum is about 24 inches. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were a few small areas of a Parleys silt loam that has slopes of slightly more than 10 percent. Also included were small areas of Hillfield silt loam, 20 to 30 percent slopes, eroded.

This Parleys soil is used mainly for dryfarmed crops of alfalfa, alfalfa and grass mixtures, and small grain. (Capability unit IIIe-2, irrigated, IIIe-UE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parlo Series

The Parlo series consists of well-drained soils that formed in mixed lake sediment derived from limestone, standstone, and quartzite. These soils are on medium and high lake terraces at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 10 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, big sagebrush, gumweed, and balsamroot. The average annual precipitation ranges from 14 to 20 inches, the mean annual air temperature is 45° to 52° F., and the frost-free season is 110 to 150 days. Parlo soils are associated with Timpanogos, Nibley, Parleys, and Hillfield soils.

In a representative profile, the surface layer is dark grayish-brown, mildly alkaline silt loam about 11 inches thick. The subsoil is grayish-brown to brown, mildly alkaline silty clay loam about 10 inches thick. The substratum is pale-brown or light-brown, moderately alkaline, moderately calcareous loam and very gravelly loamy sand to a depth of 60 inches or more.

Parlo soils are used for dryfarmed and irrigated crops.

Parlo silt loam, 0 to 3 percent slopes (PlA).—This soil is on medium lake terraces, mainly in an area between the towns of Providence and Paradise.

Representative profile in a cultivated area, 2 miles north and 1/4 mile west of Paradise church, 300 feet west of the road, 200 feet west and 200 feet south of the northwest corner of the northeast quarter of sec. 21, T. 10 N., R. 1 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; mildly alkaline; abrupt, smooth boundary.

A1—7 to 11 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few fine pores; mildly alkaline; clear, smooth boundary.

B21t—11 to 15 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many fine pores; thin continuous clay films; mildly alkaline; gradual, wavy boundary.

B22t—15 to 21 inches, brown (10YR 5/3) silty clay loam, dark brown to brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many fine pores; thin continuous clay films; mildly alkaline; clear, wavy boundary.

C1ca—21 to 30 inches, pale-brown (10YR 6/3) loam, brown to dark brown (10YR 4/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores and few medium pores; strongly calcareous; moderately alkaline; clear, smooth boundary.

IIC2—30 to 60 inches, pale-brown (10YR 6/3) very gravelly loamy sand, brown to dark brown (10YR 4/3) when moist; single grain; loose, moist and dry, nonsticky and nonplastic; common fine roots; moderately calcareous; moderately alkaline.

The A horizon ranges from 7 to 11 inches in thickness. In places the A and B horizons contain a minor amount of gravel. Depth to the very gravelly sand IIC horizon is 28 to 40 inches. The amount of gravel ranges from 30 to 70 percent and generally increases with depth.

This soil is easy to till. It is moderately permeable. Runoff is slow, and the hazard of erosion is none to slight. This soil holds 6 to 7.5 inches of available water to a depth of 5 feet, depending on the depth to gravel. Plant roots easily penetrate to the gravelly substratum.

Included in mapping were areas of deep loamy soils and small areas of gravelly loam soils.

This soil is used mostly for irrigated crops of alfalfa, small grain, sugar beets, peas, and corn for silage, and for pasture. About 25 percent of the acreage is used for dryfarmed crops. Winter wheat and alfalfa are the principal dryfarmed crops. (Capability unit IIc-2, irrigated, IIIs-U4, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parlo silt loam, 3 to 6 percent slopes (PlB).—This soil is associated with and, except for slope, is similar to Parlo silt loam, 0 to 3 percent slopes. The surface layer is 7 to 9 inches thick. Depth to underlying gravel and sand is 24 to 40 inches. Runoff is slow, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Timpanogos silt loam, 3 to 6 percent slopes, areas of deep loamy soils, and a few small areas of soils that have a gravelly loam surface layer.

This soil is used mainly for dryfarmed crops of winter wheat and alfalfa. Small areas are used for irrigated wheat and alfalfa. (Capability unit IIe-2, irrigated, IIIs-U4, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parlo silt loam, 6 to 10 percent slopes (PlC).—This soil is on medium and high lake terraces. It is closely associated with and is similar to Parlo silt loam, 0 to 3 percent slopes, except that it has slopes of 6 to 10 percent and its surface layer is 7 to 9 inches thick. The depth to the gravel and sand is 24 to 36 inches. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of gravelly loam soils.

This soil is used for dryfarmed crops of winter wheat and alfalfa. (Capability unit IIIe-UE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Payson Series

The Payson series consists of somewhat poorly drained, alkaline soils that have a silty clay subsoil. These soils formed in mixed lake sediment derived from limestone, sandstone, and shale rocks. They are on low lake terraces at elevations of 4,420 to 4,500 feet. Slopes range from 0 to 1 percent. The vegetation is greasewood, saltgrass, and pickleweed. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Payson soils are associated with Lewiston, Airport, and Salt Lake soils.

In a representative profile, the surface layer is light brownish-gray, mildly alkaline silt loam about 6 inches thick. The subsoil is grayish-brown or light brownish-gray, strongly alkaline silty clay about 11 inches thick. The substratum is very pale brown, very strongly alkaline, very strongly calcareous silty clay to a depth of 60 inches or more.

Payson soils are used for range.

Payson silt loam (Pn).—This soil is on the low lake terraces between the city of Logan and the town of Benson. Slopes range from 0 to 1 percent.

Representative profile, in a native pasture area near the southeast corner of Logan-Cache Airport, south of highway, 900 feet south and 1,100 feet west of the center of sec. 16, T. 12 N., R. 1 E.:

A21—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; slightly calcareous; mildly alkaline; gradual, smooth boundary.

A22—3 to 6 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium, platy structure; slightly hard, friable, sticky and plastic; many fine roots; slightly calcareous; mildly alkaline; clear, smooth boundary.

B21t—6 to 9 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; strong, coarse, columnar structure; very hard, firm, sticky and plastic; few fine roots; moderately thick continuous clay films; moderately calcareous; moderately alkaline; clear, wavy boundary.

B22tca—9 to 17 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) when moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and plastic; common fine roots; common thin clay films; strongly calcareous; strongly alkaline; gradual, wavy boundary.

B3ca—17 to 21 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, very firm, sticky and plastic; strongly calcareous; very strongly alkaline; gradual, wavy boundary.

C1ca—21 to 60 inches, very pale brown (10YR 7/3) silty clay, pale brown (10YR 6/3) when moist; weak, medium, subangular blocky structure; very hard, very firm, sticky and plastic; very strongly calcareous; very strongly alkaline.

In places there is a thin A1 horizon. The A2 horizon ranges from light brownish gray to light gray or grayish brown. Texture ranges from silt loam to light silty clay loam. Reaction is mildly alkaline to moderately alkaline. Thickness ranges from 4 to 8 inches. The B2t horizon ranges from grayish brown or light brownish gray to brown or pale brown. Texture ranges from silty clay to clay or to heavy silty clay loam. The upper part of the B2t horizon has strong, medium, or coarse columnar structure, and the lower part has moderate to strong, medium, or coarse prismatic structure. Reaction ranges from moderately alkaline to very strongly alkaline. The exchangeable sodium percentage ranges from 15 to 35. The horizon is moderately to strongly calcareous. The C horizon ranges from very pale brown to white or to pale brown. Texture ranges from silty clay to silt loam. Reaction is strongly alkaline to very strongly alkaline, and the horizon is strongly calcareous or very strongly calcareous. The exchangeable sodium percentage is 20 to 95. The calcium carbonate equivalent ranges from 15 to 50 percent.

Permeability is very slow. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is 3 to 4 inches. Most roots are generally within the upper 8 to 12 inches of the profile because of the high concentration of alkali and salt in the subsoil and substratum. The water table fluctuates seasonally but generally is at a depth of 30 to 50 inches.

Included in mapping were areas of Lewiston fine sandy loam, moderately deep over clay, small areas of poorly drained soils, and areas of ponded soils.

This soil is used for range. The carrying capacity is low. (Capability unit VIIw-285, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Picayune Series

The Picayune series consists of well-drained soils that have a gravelly clay loam subsoil. These soils formed in residuum and colluvium derived from limestone and calcareous sandstone. They are on mountain slopes on all aspects, but generally are on west-facing slopes. The elevation ranges from 5,500 to 7,000 feet, and slopes range from 50 to 80 percent. The vegetation is bluebunch wheatgrass, native bluegrass, bitterbrush, big sagebrush, balsamroot, and herbaceous sage. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 42° to 46° F., and the frost-free season is 80 to 100 days. Picayune soils are associated with Agassiz, Bradshaw, Sheep Creek, Richmond, and Despain soils.

In a representative profile, the surface layer is grayish-brown or brown, neutral gravelly loam about 14 inches thick. The subsoil is brown or pale-brown, mildly alkaline gravelly light clay loam about 15 inches thick. The substratum is pale-brown, strongly calcareous, strongly alkaline gravelly silt loam to a depth of 60 inches or more.

Picayune soils are used for range, watershed, and wildlife habitat.

Picayune-Agassiz association, eroded (30 to 80 percent slopes) (POG2).—This mapping unit is on south- and west-facing slopes of mountains, mostly east of Cache Valley and extending from Blacksmith Fork Canyon to East Canyon. A small area is on the Clarkston Mountains. About 65 percent of the association is Picayune gravelly loam, 50 to 80 percent slopes, eroded; 25 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and 10 percent is included soils.

The Picayune soil is on the lower part of slopes and in slightly concave areas.

The Agassiz soil is on the upper part of slopes and in convex areas. In the Clarkston Mountains, it has slightly more outcrops of rock than in other areas.

Representative profile of Picayune gravelly loam, 50 to 80 percent slopes, in an area of Picayune-Agassiz association, eroded, 500 feet northeast of the old mine south of the mouth of the Blacksmith Fork Canyon, about 200 feet north and 400 feet east of the southwest corner of sec. 12, T. 10 N., R. 1 E.:

A11—0 to 7 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine roots and few medium roots; 20 percent gravel; neutral; clear, wavy boundary.

A12—7 to 14 inches, brown (10YR 5/3) gravelly heavy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many fine roots and few medium roots; few, very fine and micro, continuous, random, tubular pores; 25 percent gravel; neutral; clear, wavy boundary.

B21—14 to 19 inches, brown (10YR 5/3) gravelly light clay loam, brown to dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots; few, very fine, continuous, random, tubular pores; few thin clay films in pores and on compression faces; 25 percent gravel; neutral; gradual, wavy boundary.

B22—19 to 29 inches, pale-brown (10YR 6/3) gravelly light clay loam, brown to dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine roots; few, very fine, continuous, random, tubular pores; few thin clay films in pores; 25 percent gravel; very slightly calcareous, lime is nonindurated, massive and flaky; mildly alkaline; gradual, wavy boundary.

Cca—29 to 60 inches, pale-brown (10YR 6/3) gravelly silt loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; few fine roots at a depth above 48 inches; few, very fine, random, tubular pores; 40 percent gravel; very strongly calcareous, lime is nonindurated, massive and flaky; strongly alkaline.

The A1 horizon ranges from gravelly loam or cobbly loam to stony loam that is 15 to 40 percent gravel and cobblestones and is as much as 5 percent stones in places. Reaction is neutral to mildly alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness ranges from 7 to 15 inches. The B2 horizon has a hue of 10YR or 7.5YR. This horizon ranges from gravelly light clay loam to cobbly heavy loam and is 20 to 50 percent cobblestones and gravel. Reaction ranges from neutral to moderately alkaline, and the horizon is noncalcareous to moderately calcareous. Thickness ranges from 10 to 18 inches. The Cca horizon ranges from pale brown to brown or yellowish brown in a hue of 10YR or 7.5YR. This horizon ranges from gravelly silt loam or gravelly sandy loam to very gravelly or very cobbly sandy loam that is 40 to 60 percent gravel and cobblestones. Reaction is mildly alkaline to strongly alkaline, and the horizon is strongly calcareous to very strongly calcareous.

Permeability is moderate. Runoff is very rapid, and the hazard of erosion is very high. This soil holds 5 to 7.5 inches of available water to a depth of 5 feet. Roots penetrate to a depth of about 48 inches.

Included in mapping were areas of soils that are similar to the Elzinga soils.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Picayune soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 3)

Picayune-Smarts association (30 to 80 percent slopes) (PRG).—This mapping unit is on colluvial scarp slopes in drainages on Wellsville Mountain. About 40 percent of the association is Picayune cobbly loam, 50 to 80 percent slopes; 30 percent is Smarts gravelly silt loam, 30 to 70 percent slopes; 20 percent is Dateman cobbly silt loam, 40 to 70 percent slopes; 8 percent is rock outcrops; and about 2 percent is included soils.

The Picayune soil is on the upper side slopes that have a northwestern aspect. It is similar to Picayune gravelly loam, 50 to 80 percent slopes, except that it has cobblestone-size coarse fragments on the surface and throughout the profile.

The Smarts soil is on steep side slopes adjacent to drainageways. It is similar to Smarts silt loam, 10 to 30 percent slopes, except that it has slopes of 30 to 70 percent. The surface layer is 20 to 30 percent gravel and is 15 to 25 inches thick.

The Dateman soil is on north-facing slopes below ridges of rock outcrops.

Included in mapping were areas of deep alluvial soils.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Picayune soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Smarts soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 3)

Poleline Series

The Poleline series consists of well-drained soils that have a very gravelly very fine sandy loam subsoil. These soils formed in colluvium derived from sandstone. They are on slopes of mountains adjacent to drainageways at elevations of 7,000 to 9,000 feet. Slopes range from 30 to 70 percent. The vegetation is mountain-ash, willows, scrubby aspen, and mountain brome. The average annual precipitation ranges from 25 to 30 inches, the mean annual air temperature is 38° to 45° F., and the frost-free season is 70 to 90 days. Poleline soils are associated with Lucky Star, Smarts, Bickmore, and Agassiz soils.

In a representative profile, the surface layer is dark grayish-brown and brown, neutral gravelly loam about 20 inches thick. The subsoil is brown, medium acid very gravelly and cobbly light loam.

Representative profile of Poleline gravelly loam, 30 to 70 percent slopes, in an area of Smarts-Lucky Star-Poleline association, on the east face of Wellsville Mountain on Cold Spring Trail below Stewart Pass, Cache National Forest, in the southwest quarter of the northeast quarter of sec. 25, T. 11 N., R. 2 W.:

A11—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, granular structure; soft, very friable, slightly sticky and nonplastic; many fine roots; neutral; clear, wavy boundary.

A12—8 to 20 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 3/3) when moist; weak, medium and coarse, subangular blocky structure that parts to weak granular structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots and few coarse roots; slightly acid; clear, wavy boundary.

A13—20 to 32 inches, brown (10YR 5/3) very gravelly very fine sandy loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure that parts to weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and very fine roots; medium acid; abrupt, wavy boundary.

B2—32 to 60 inches, brown (10YR 5/3) very gravelly and cobbly light loam, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine roots and common medium roots; few thin clay films; medium acid; abrupt, irregular boundary.

The combined thickness of the A and B horizons ranges from 40 to more than 60 inches over the bedrock. Gravel and cobblestones are throughout the profile and gradually increase with depth. Coarse fragments are cobblestone- and gravel-size, angular or rounded sandstone and quartzite rock fragments. Their content ranges from 20 to 70 percent in the A horizon and from 40 to 80 percent in the B horizon. The A1 horizon ranges from dark grayish brown or grayish brown to brown or dark brown in hues of 10YR and 7.5YR. Texture ranges from gravelly loam, very gravelly loam, or cobbly loam to gravelly very fine sandy loam. Thickness ranges from 20 to 35 inches. The B2 horizon ranges from brown to light brown in a hue of 10YR or 7.5YR. Texture ranges from very gravelly light loam or very gravelly sandy loam to very cobbly very fine sandy loam. Reaction is slightly acid to medium acid.

Permeability is moderately rapid. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 5 to 7.5 inches of available water. Roots penetrate to a depth of 5 feet or more.

Poleline soils are used for watershed and wildlife habitat.

Poleline-Agassiz association, eroded (30 to 70 percent slopes) (PSG2).—This mapping unit is near the crest of Wellsville Mountain. About 45 percent of the association is Poleline gravelly loam, 30 to 70 percent slopes; 45 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and about 10 percent is included soils.

The Poleline soil is on very steep slopes adjacent to drainageways. The vegetation is scrubby aspen, willow, mountain-ash, and grass.

The Agassiz soil is on upper slopes and on ridges. The areas are about 20 percent rock outcrop and rock slides.

Included in mapping were areas of Elzinga silt loam, 30 to 60 percent slopes.

Soils of this mapping unit are used for watershed and wildlife habitat. (Poleline soil is in capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site. Agassiz soil is in capability unit VIIs-MX3, nonirrigated; Mountain Shallow Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 3)

Preston Series

The Preston series consists of excessively drained soils that formed in wind-sorted lakeshore sediment. These soils are on rolling sand dunes at elevations of 4,470 to 4,500 feet. Slopes range from 0 to 10 percent. The vegetation is sand dropseed, Indian ricegrass, cheatgrass, and big rabbitbrush. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 46° to 48° F., and the frost-free season is 130 to 140 days. Preston soils are associated with Layton, Kidman, and Lewiston soils.

In a representative profile, the soil is dark grayish-brown to yellowish-brown, mildly alkaline fine sand to a depth of 60 inches or more.

Preston soils are used chiefly for range or are idle. Small areas are sprinkler irrigated and are used for crops of alfalfa and small grain or for pasture.

Preston fine sand, 0 to 10 percent slopes (PtC).—This soil is on rolling, partially stabilized sand dunes deposited on medium lake terraces north of the town of Cornish.

Representative profile in an uncultivated area, 2,200 feet south of the Idaho line, 1,150 feet east of State Highway No. 23, in Cornish, 700 feet north and 1,200 feet east of the southwest corner of sec. 34, T. 15 N., R. 1 W.:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose, nonsticky and nonplastic; common fine roots; noncalcareous; mildly alkaline; gradual, wavy boundary.

AC—6 to 15 inches, brown (10YR 5/3) fine sand, dark yellowish brown (10YR 3/4) when moist; single grain; loose, nonsticky and nonplastic; common fine roots; noncalcareous; mildly alkaline; diffuse, smooth boundary.

C1—15 to 26 inches, yellowish-brown (10YR 5/4) fine sand, dark yellowish brown (10YR 4/4) when moist; single grain; loose, nonsticky and nonplastic; few fine roots; noncalcareous; mildly alkaline; diffuse, smooth boundary.

C2—26 to 64 inches, yellowish-brown (10YR 5/4) fine sand, dark yellowish brown (10YR 4/4) when moist; single grain; loose, nonsticky and nonplastic; few fine roots; noncalcareous; mildly alkaline.

Texture of the A1 horizon is dominantly fine sand but is loamy fine sand in places. This horizon is 6 to 8 inches thick. The lower part of the C horizon is moderately calcareous in some areas.

This soil is very rapidly permeable. Runoff is very slow, and the hazard of water erosion is very slight. The hazard of soil blowing is high. This soil holds 2.5 to 3.75 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of soils where soil blowing has removed the surface layer.

This soil is used mostly for range. Some small areas are irrigated by sprinkler, and alfalfa and small grain are grown. Capability unit IVs-24, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Provo Series

The Provo series consists of poorly drained, very gravelly loamy soils. These soils formed in gravelly mixed alluvium derived from limestone, sandstone, and quartzite. They are on flood plains and fans at elevations of 4,475 to 4,650 feet. Slopes range from 0 to 3 percent. The vegetation is sedge, wiregrass, Kentucky bluegrass, and saltgrass. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 140 days. Provo soils are associated with Logan, Collett, Roshe Springs, and Winn soils.

In a representative profile, the surface layer is dark-gray to grayish-brown, mildly alkaline gravelly loam about 13 inches thick. The next layer is grayish-brown or light-gray, mildly alkaline very gravelly light loam 14 inches thick. Below this is light-gray, mildly alkaline very gravelly sandy loam to a depth of 60 inches or more.

Provo soils are used mainly for range.

Provo gravelly loam (Pv).—This undulating soil is on flood plains of rivers. Slopes range from 0 to 3 percent.

Representative profile in a wet meadow area, 1¼ miles south of Logan Sugar Factory, 40 feet north and 700 feet west of the southeast corner of sec. 17, T. 11 N., R. 1 E.:

O2—2 inches to 0, grayish-brown (10YR 5/2) peaty gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; strongly calcareous; mildly alkaline; clear, smooth boundary.

A11—0 to 7 inches, dark-gray (10YR 4/1) gravelly loam, black (10YR 2/1) when moist; strong, coarse, granular structure; slightly hard, friable, slightly sticky and plastic; common fine roots; 20 percent gravel; moderately calcareous; mildly alkaline; gradual, wavy boundary.

A12—7 to 13 inches, grayish-brown (2.5Y 5/2) gravelly loam, very dark grayish brown (2.5Y 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; 35 percent gravel; moderately calcareous; mildly alkaline; gradual, irregular boundary.

C1ca—13 to 19 inches, light-gray (10YR 7/2) very gravelly light loam, light brownish gray (10YR 6/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; 70 percent gravel; strongly calcareous; mildly alkaline; gradual, irregular boundary.

C2ca—19 to 27 inches, light-gray (10YR 7/2) very gravelly light loam, light brownish gray (10YR 6/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; 75 percent gravel; strongly calcareous; mildly alkaline; clear, wavy boundary.

C3ca—27 to 60 inches, light-gray (10YR 7/2) very gravelly sandy loam, light brownish gray (10YR 6/2) when moist; many, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; loose, nonsticky and nonplastic; 85 percent gravel; strongly calcareous; mildly alkaline.

In uncultivated areas a thin peaty horizon ranging from 1 to 3 inches in thickness has formed on the surface of the A1 horizon. The A1 horizon is dominantly gravelly loam but is silty loam in places. Strong-brown to dark yellowish-brown mottles are present in the C horizon. Texture of the C horizon, below a depth of 24 inches, ranges from very gravelly light loam to very gravelly loamy sand. In places, particularly in an area south of the old Logan Sugar Factory, the gravel in the C horizon is weakly cemented with lime. This is most common at a depth below 36 inches.

Permeability is moderately rapid. This soil is moderately difficult to till. Runoff is slow, and the hazard of erosion is slight. This soil holds about 3.5 inches of available water to a depth of 5 feet. Most roots are above the water table, which is at a depth of 26 to 36 inches.

Included in mapping were small areas of ponded soils, a few small areas of Roshe Springs silt loam, and small areas of soils that have slopes of 3 to 5 percent.

This soil is used mainly for native meadow pasture. Small areas have been partially drained and are used for irrigated crops of alfalfa, small grain, corn for silage, and pasture. (Capability unit Vw–2, nonirrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Provo loam (Pu).—This soil is on flood plains, mainly along the Blacksmith Fork and Little Bear Rivers. It is similar to Provo gravelly loam, except that it has little or no gravel in the upper 8 to 15 inches of the profile and its slopes are 0 to 1 percent. The surface layer is as much as 10 percent gravel in some places. The depth to the very gravelly substratum ranges from 13 to 37 inches.

The permeability is moderate in the surface layer and rapid in the gravelly substratum. Runoff is slow, and the hazard of erosion is slight. The depth to the water table normally ranges from 28 to 36 inches. In some places, however, drains have been installed and the water table has been lowered to a depth of 50 inches or more. Most roots penetrate to the gravelly material with ease.

Included in mapping were small areas of ponded soils and oxbows. Also included were small areas of Winn silt loam, 0 to 3 percent slopes.

This Provo soil is used mostly for irrigated crops of alfalfa, small grain, improved pasture, and corn for silage. A few acres of sugar beets also are grown. (Capability unit IIIw–2, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Quinney Series

The Quinney series consists of moderately well drained soils that are affected by salt and alkali. These soils formed in mixed lake sediment derived mainly from limestone and sandstone rocks. They are on low lake terraces at elevations of 4,420 to 4,500 feet. Slopes range from 0 to 2 percent. The vegetation is saltgrass, alkali sacaton, foxtail, cheatgrass, and greasewood. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Quinney soils are associated with Lewiston, Trenton, Kidman, and Airport soils.

In a representative profile, the surface layer is grayish-brown, mildly alkaline silt loam about 8 inches thick. The subsoil is grayish-brown and light brownish-gray, moderately and strongly alkaline loam about 10 inches thick. The substratum is very pale brown, very strongly alkaline loam to a depth of 39 inches. Between depths of 39 and 60 inches is very pale brown, strongly alkaline silty clay.

Most areas of Quinney soils are used for irrigated crops, but small areas are used for dryfarming and pasture.

Quinney silt loam (Qu).—This soil is on low lake terraces extending from the Lewiston-Cornish area south to the vicinity of the town of Benson. Slopes are 0 to 1 percent.

Representative profile in a cultivated area, 2 miles west and 1½ miles south of Lewiston, 100 feet north and 200 feet east of the southwest corner of the northwest quarter of sec. 18, T. 14 N., R. 1 E.:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine and medium pores; noncalcareous; mildly alkaline; clear, smooth boundary.

B21t—8 to 12 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine roots; many fine pores; thin continuous clay films; noncalcareous; moderately alkaline; gradual, smooth boundary.

B22t—12 to 18 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; many fine pores; many thin clay films; moderately calcareous; strongly alkaline; clear, smooth boundary.

C1ca—18 to 26 inches, pale-brown (10YR 6/3) heavy loam, brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common fine pores and few medium pores; strongly calcareous; very strongly alkaline; gradual, wavy boundary.

C2—26 to 39 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine pores; strongly calcareous; very strongly alkaline; abrupt, smooth boundary.

IIC3—39 to 60 inches, very pale brown (10YR 7/3) silty clay, brown (10YR 5/3) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; extremely hard, very firm, sticky and plastic; common fine pores; strongly calcareous; strongly alkaline.

The A horizon ranges from grayish brown to brown. Texture ranges from silt loam to fine sandy loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness ranges from 6 to 10 inches. The B2t horizon ranges from grayish brown or light brownish gray to brown or light brown in hues of 10YR and 7.5YR. Texture ranges from loam to very fine sandy loam or silt loam. The horizon is noncalcareous to moderately calcareous. Thickness ranges from 8 to 13 inches. The Cca and C horizons range from pale brown or very pale brown to light brown. Texture generally ranges from silt loam or loam to silty clay, but some areas are fine sandy loam. Most of the carbonate has been leached from the surface and redeposited in the lower part of the B horizon and upper part of the C horizon.

This soil is fairly easy to till. Permeability generally is moderately slow, but in an area south of Benson, the substratum is sandy loam and is rapidly permeable. Runoff is slow, and the hazard of erosion is none to slight. This soil holds 5 to 6 inches of available water to a depth of 5 feet. The fine-textured lake sediment generally present at a depth of 38 to 54 inches restricts the downward movement of water, and the water table is at a depth of 30 to 50 inches. Where drains have been installed, however, the water table generally is below a depth of 60 inches. Roots are mostly at a depth above the strongly alkali horizons.

Included in mapping were small areas of sandy loams and small slickspots that are strongly affected by salt and alkali.

This soil is used mostly for irrigated crops of alfalfa, barley, sugar beets, corn for silage, and alkali-tolerant pasture plants. Small areas are used for native pasture. (Capability unit IIIw-28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Red Spur Series

The Red Spur series consists of well-drained soils that have a cobbly sandy clay loam subsoil. These soils formed in residuum and colluvium derived from Wasatch sandstone and conglomerate rocks. They are on mountain slopes at elevations of 7,500 to 8,500 feet. Slopes range from 10 to 30 percent. The vegetation is aspen and an understory of big sagebrush, snowberry, mountain brome, Columbia needlegrass, slender wheatgrass, yarrow, and larkspur. The average annual precipitation ranges from 25 to 35 inches, the average annual air temperature is 35° to 40° F., and the average soil temperature in summer is less than 59°. The frost-free season is 60 to 80 days. Red Spur soils are associated with Lucky Star, Cluff, Scout, Agassiz, and Mult soils.

In a representative profile, the surface layer is brown to dark-brown, medium acid loam about 26 inches thick. The subsurface layer is pink, medium acid fine sandy loam about 12 inches thick. The next layer is pink fine sandy loam and red sandy clay loam about 10 inches thick. The subsoil is red, medium acid cobbly sandy clay loam to a depth of 56 inches. Below that depth is sandstone.

Representative profile of Red Spur loam, 10 to 30 percent slopes, in an area of Lucky Star-Red Spur complex, 6 to 30 percent slopes, 1 mile west and ½ mile north of Monte Cristo Guard Station, 2,000 feet north and 1,000 feet west of the southeast corner of sec. 31, T. 9 N., R. 4 E.:

A11—0 to 5 inches, brown to dark-brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; many medium and fine roots; slightly acid; clear, wavy boundary.

A12—5 to 26 inches, brown to dark-brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; many medium and fine roots; medium acid; clear, wavy boundary.

A2—26 to 38 inches, pink (7.5YR 7/4) fine sandy loam, strong brown (7.5YR 5/6) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; medium acid; gradual, wavy boundary.

A&B—38 to 48 inches, mixed about 70 percent pink (7.5YR 7/4) fine sandy loam (A2 horizon) and 30 percent red (2.5YR 4/6) (dry and moist) sandy clay loam (B2t horizon); moderate, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; few fine and medium roots; moderate continuous clay films on the B2t peds; medium acid; gradual, irregular boundary.

B2t—48 to 56 inches, red (2.5YR 4/6) (dry and moist) cobbly sandy clay loam; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky and plastic; few fine and medium roots; moderately thick continuous clay films on peds; medium acid.

R—56 inches, sandstone.

The combined thickness of the A1, A2, and B2t horizons ranges from 48 to more than 60 inches over sandstone. Coarse fragments are mainly cobblestone- and gravel-size, angular sandstone rock fragments that make up 20 to 50 percent in the A2 and B2t horizons. The A1 horizon ranges from brown to dark brown or reddish brown in a hue of 10YR, 7.5YR, or 5YR. Texture of the A1 horizon ranges from loam to very fine sandy loam. Thickness ranges from 22 to 30 inches. The A2 horizon ranges from brown to pink or reddish yellow in hues of 7.5YR and 5YR. Texture ranges from fine sandy loam to loamy fine sand. Reaction is medium acid to slightly acid. Thickness ranges from 10 to 13 inches. The A2 horizon tongues 4 to 13 inches into the B2t horizon. The B2t horizon ranges from red or reddish yellow to yellowish red or reddish brown in a hue of 2.5YR or 5YR. Texture is cobbly sandy clay loam to cobbly clay loam that is 20 to 50 percent cobblestones and gravel. Reaction is medium acid to slightly acid.

Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. These soils hold 6 to 8 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more.

Red Spur soils are used for range, watershed, wildlife habitat, and woodland.

In this survey area, the Red Spur soils are mapped only in a complex with the Lucky Star soils.

Richmond Series

The Richmond series consists of somewhat excessively drained, very cobbly and stony soils that formed in residuum and colluvium derived from limestone. The depth to limestone bedrock ranges from 10 to 20 inches. These soils are on south- and west-facing foot slopes of mountains at elevations of 5,100 to 6,500 feet. Slopes range from 30 to 70 percent. The vegetation is big sagebrush, bluebunch wheatgrass, cheatgrass, balsamroot, and juniper. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 100 to 120 days. Richmond soils are associated with Sterling, Nebeker, and Picayune soils.

In a representative profile, the surface layer is pale-brown, mildly alkaline very stony loam about 8 inches thick. The underlying layer is brown cobbly loam and pale-brown very cobbly loam. It is mildly alkaline and about 10 inches thick over limestone bedrock.

Richmond soils are used for range, watershed, and wildlife habitat.

Richmond very stony loam, 30 to 70 percent slopes, eroded (RCG2).—This soil is on the west- and south-facing mountain foothills along the east side of Cache Valley.

Representative profile, under native shrubs and grass in Hyde Park Canyon, about 1,000 feet south and 100 feet west of the northeast corner of sec. 1, T. 12 N., R. 1 E.:

A1—0 to 8 inches, pale-brown (10YR 6/3) very stony loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; many fine roots and few medium and large roots; many fine and medium interstitial pores; very strongly calcareous; mildly alkaline; clear, wavy boundary.

C1—8 to 13 inches, brown (10YR 5/3) cobbly loam, dark brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; many fine roots and few medium roots; many fine pores; very strongly calcareous; mildly alkaline; gradual, wavy boundary.

C2—13 to 18 inches, pale-brown (10YR 6/3) very cobbly loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; many fine roots and few medium roots; very strongly calcareous; mildly alkaline.

R—18 inches, fractured limestone bedrock.

The A1 horizon ranges from pale brown to brown or light grayish brown. Its texture is loam that is very stony, cobbly, or very cobbly. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to very strongly calcareous. Thickness ranges from 6 to 9 inches. The C horizon ranges from pale brown or brown to very pale brown or grayish brown. Reaction is mildly alkaline to moderately alkaline, and the horizon is strongly calcareous to very strongly calcareous. Coarse fragments are mainly cobblestones and gravel derived from limestone and a few stones. Their content ranges from 20 to 70 percent in the A horizon and the upper part of the C horizon and from 50 to 80 percent in the lower part of the C horizon. The fine fraction commonly is less than 15 percent carbonates; however, the carbonate equivalent throughout the profile, including coarse fragments as much as three-fourths inch in diameter, is more than 40 percent.

Permeability is moderately rapid. Runoff is rapid, and the hazard of erosion is high. This soil is moderately eroded. It holds 1.5 to 2 inches of available water above bedrock. Roots are at a depth of 10 to 20 inches. Some roots penetrate into cracks in the bedrock.

This soil is used for range, watershed, and wildlife habitat. (Capability unit VIIs–UX3, nonirrigated; Upland Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Richmond-Middle association, eroded (30 to 70 percent slopes) (RDG2).—This mapping unit is on mountain slopes on the west side of Clarkston and Wellsville Mountains. About 40 percent of the association is Richmond very stony loam, 30 to 70 percent slopes, eroded; 30 percent is Middle cobbly loam, 30 to 70 percent slopes; 20 percent is rock outcrop; and 10 percent is included soils.

The Richmond soil is on the lower part of south- and southwest-facing slopes. The Middle soil is on north-facing slopes below ridges.

Included in mapping were areas of very shallow, stony soils that are 7 to 10 inches deep over limestone bedrock, and areas of soils that are steeper. The shallow soils and rock outcrop are intermingled with areas of the Richmond soil.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Richmond soil is in capability unit VIIs–UX3, nonirrigated; Upland Shallow Loam range site. Middle soil is in capability unit VIIs–U4, nonirrigated; Upland Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 2)

Richmond-Munk association, eroded (30 to 70 percent slopes) (REG2).—This mapping unit is on the north end of Clarkston Mountain near the Idaho line. About 50 percent of the association is Richmond very stony loam, 30 to 70 percent slopes, eroded; 35 percent is Munk gravelly loam, 30 to 70 percent slopes, eroded; and 15 percent is included soils.

The Richmond soil is on the south- and southwest-facing mountain slopes. It is very shallow, is excessively drained, and contains ashy material from the Salt Lake Formation. Permeability is moderately rapid. Runoff is rapid, and the hazard of erosion is very high. This soil holds less than 1½ inches of available water above bedrock. Some roots penetrate into the cracks in the bedrock. The vegetation is scattered stands of mountain-mahogany and juniper and a sparse understory of bluebunch wheatgrass.

The Munk soil is on the north- and east-facing mountain slopes. In these areas, the vegetation is thick stands of mountain-mahogany.

Included in mapping were areas of Barfuss silt loam, 30 to 50 percent slopes, and areas of Wheelon silt loam, 30 to 50 percent slopes, eroded. The Barfuss soil makes up 10 percent of the association and the Wheelon soil 5 percent.

Soils of this mapping unit are used for watershed, wildlife habitat, and limited grazing. (Richmond soil is in capability unit VIIs-UX3, nonirrigated; Upland Shallow Loam range site. Munk soil is in capability unit VIIs-U4, nonirrigated; Upland Stony Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 2)

Richmond-Nebeker association, eroded (30 to 70 percent slopes) (RFG2).—This mapping unit is on rolling foothills of mountains along the east side of Cache Valley and extends from Hyde Park to the Richmond area. About 40 percent of the association is Richmond very stony loam, 30 to 70 percent slopes, eroded; 25 percent is Nebeker silt loam, 30 to 40 percent slopes; 20 percent is Sterling cobbly loam, 30 to 60 percent slopes, eroded; and 15 percent is included soils.

The Richmond soil is on south- and west-facing slopes and on ridges. The vegetation is grass and shrubs.

The Sterling and Nebeker soils are on north-facing slopes. The Sterling soil is commonly on the upper part of the slopes, and the Nebeker soil is in the lower, more concave areas. The Sterling soil is similar to Sterling gravelly loam, 30 to 50 percent slopes, eroded, except that the surface layer is about 30 percent cobblestones and is slightly darker colored. The Nebeker soil is similar to Nebeker silt loam, 10 to 25 percent slopes, except that it has slopes of 30 to 40 percent.

Included in mapping were areas of Smarts gravelly silt loam, 30 to 70 percent slopes, and areas of Hiibner extremely stony clay loam, 30 to 50 percent slopes, eroded.

Soils of this mapping unit are used for range, wildlife habitat, and watershed. (Richmond soil is in capability unit VIIs-UX3, nonirrigated; Upland Shallow Loam range site. Nebeker soil is in capability unit VIIe-M, nonirrigated; Mountain Loam range site. Sterling soil is in capability unit VIIs-U4, nonirrigated; Upland Stony Loam range site. None of these soils is in a woodland suitability group; Richmond and Sterling soils are in wildlife suitability group 2; Nebeker soil is in wildlife suitability group 3)

Richmond-Sterling association, eroded (30 to 70 percent slopes) (RGG2).—This mapping unit is on foot slopes of mountains along the east side of Cache Valley and extends from Smithfield to the Idaho line. About 50 percent of the association is Richmond very stony loam, 30 to 70 percent slopes, eroded; 35 percent is Sterling cobbly loam, 30 to 60 percent slopes, eroded; and about 15 percent is included soils.

The Richmond soil is on the south-facing slopes of draws and canyons and on ridges.

The Sterling soil is in slightly concave areas, mainly on the upper part of north-facing slopes. It is similar to Sterling gravelly loam, 10 to 20 percent slopes, except that it is steeper, it is eroded, and the surface layer is 30 percent cobblestones.

Included in mapping were areas of a moderately deep, well-drained, cobbly and gravelly, medium-textured soil, and areas of Nebeker silt loam, 30 to 40 percent slopes. The moderately deep soil makes up about 10 percent of the association, and the Nebeker soil about 5 percent. These inclusions are on the lower part of north-facing slopes, and the vegetation generally is scrubby maple and other browse.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Richmond soil is in capability unit VIIs-UX3, nonirrigated; Upland Shallow Loam range site. Sterling soil is in capability unit VIIs-U4, nonirrigated; Upland Stony Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 2)

Ricks Series

The Ricks series consists of somewhat excessively drained, gravelly soils that are 15 to 30 inches deep over very gravelly sand. These soils formed in mixed alluvium and deltaic sediment derived from limestone, sandstone, and quartzite. They are on medium and high lake terraces at elevations of 4,500 to 5,700 feet. Slopes range from 0 to 10 percent. The vegetation is bluebunch wheatgrass, balsamroot, and big sagebrush. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 130 to 160 days. Ricks soils are associated with Sterling, Steed, Parleys, and Timpanogos soils.

In a representative profile (fig. 10), the surface layer and subsoil are brown, mildly alkaline gravelly loam and

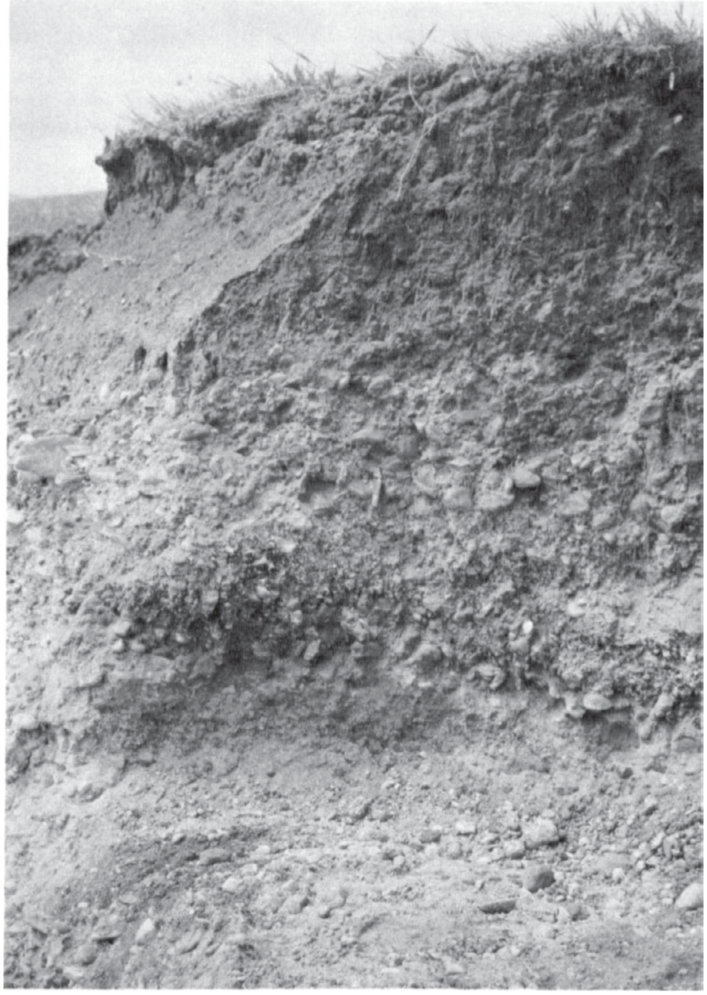

Figure 10.—**Profile of Ricks gravelly loam, 0 to 3 percent slopes.**

gravelly sandy loam about 18 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown very gravelly and cobbly sand.

Ricks soils are used mostly for irrigated and dryfarmed crops of alfalfa and small grain. Some areas are used for orchard, range, or community developments.

Ricks gravelly loam, 0 to 3 percent slopes (RhA).—This soil is on the rather narrow lake terraces and broad deltas along the east side of Cache Valley.

Representative profile, 1 mile east and 1,600 feet south of the southeast corner of Hyrum city rodeo grounds, 700 feet north and 200 feet east of the southwest corner of sec. 2, T. 10 N., R. 1 E.:

Ap—0 to 4 inches, brown (10YR 5/3) gravelly light loam, dark brown (10YR 3/3) when moist; mixed weak, medium, subangular blocky structure and weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few fine pores; noncalcareous; mildly alkaline; clear, smooth boundary.

A1—4 to 9 inches, brown (10YR 5/3) gravelly light loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure that parts to weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine and medium pores; few thin clay films in pores; noncalcareous; mildly alkaline; clear, wavy boundary.

B2—9 to 14 inches, brown (7.5YR 5/3) gravelly light loam, dark brown (7.5YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine and medium pores; common thin clay films; noncalcareous; mildly alkaline; clear, smooth boundary.

B3ca—14 to 18 inches, brown (7.5YR 5/3) gravelly heavy sandy loam, dark brown (7.5YR 3/3) when moist; weak, medium, subangular blocky structure; loose, very friable, nonsticky and nonplastic; common fine roots; common fine and medium pores; moderately calcareous; mildly alkaline; abrupt, smooth boundary.

IIC1ca—18 to 24 inches, very pale brown (10YR 7/3) very gravelly and cobbly sand, pale brown (10YR 6/3) when moist; single grain; loose, nonsticky and nonplastic; very strongly calcareous; moderately alkaline; gradual, wavy boundary.

IIC2ca—24 to 60 inches, very pale brown (10YR 7/3) very gravelly and cobbly sand, pale brown (10YR 6/3) when moist; single grain; loose, nonsticky and nonplastic; very strongly calcareous; moderately alkaline.

The A horizon ranges from brown to dark brown or to dark grayish brown in a hue of 10YR or 7.5YR. Reaction is neutral to mildly alkaline. Thickness ranges from 4 to 12 inches. The B2 horizon ranges from brown to reddish brown in a hue of 7.5YR or 5YR. Texture ranges from gravelly loam to gravelly heavy sandy loam. Thickness ranges from 5 to 10 inches. The C horizon ranges from very pale brown to light brown or light brownish gray in hues of 10YR and 7.5YR. Texture is very gravelly or very cobbly sand to very gravelly loamy sand. Depth to the IIC horizon of very gravelly or very cobbly sand ranges from 15 to 30 inches. The coarse fragments are mainly rounded gravel-size quartzite, sandstone, or limestone. Their content ranges from 15 to 45 percent in the A and B horizons and 50 to 80 percent in the C horizon.

This soil is fairly easy to till, but the gravel causes excessive wear on tillage implements. Permeability is moderately rapid. Runoff is slow, and the hazard of erosion is slight. This soil holds 3 to 4 inches of available water to a depth of 5 feet. Most roots are in the surface layer and subsoil above the very gravelly material.

Included in mapping were small areas of Timpanogos silt loam, 0 to 3 percent slopes.

This Ricks soil is used for irrigated and dryfarmed crops and for community developments. About 50 percent of the cropland is used for irrigated crops of small grain, alfalfa, and orchards. The other 50 percent is used for dryfarmed small grain and alfalfa. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Ricks gravelly loam, 3 to 6 percent slopes (RhB).—This soil is in long, narrow bands on medium lake terraces. It is associated with Ricks gravelly loam, 0 to 3 percent slopes, and, except for slope, is similar to that soil. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Timpanogos silt loam, 3 to 6 percent slopes, and Sterling gravelly loam, 6 to 10 percent slopes.

This Ricks soil is well suited to orchards in areas where good air movement reduces frost damage and irrigation water is available. About 50 percent of the cropland is irrigated. The principal crops are small grain, alfalfa, and orchard crops. The other 50 percent is used for dryfarmed crops of small grain and small pastures. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Ricks gravelly loam, 6 to 10 percent slopes (RhC).—This soil is in long, narrow bands on lake terrace escarpments. Except for slope, it is similar to Ricks gravelly loam, 0 to 3 percent slopes. The surface layer is 4 to 6 inches thick and is cobbly and moderately calcareous in places. The average depth to the very gravelly substratum is about 16 inches. This soil holds 3.0 to 3.5 inches of available water to a depth of 5 feet. Runoff is medium, and the hazard of erosion is moderate.

This soil is used mostly for irrigated crops of alfalfa or grass (fig. 11) and for orchards, uses to which it is suited. Some of the more narrow areas are in native vegetation consisting of sagebrush and bluebunch wheatgrass. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Riverwash

Riverwash (Rk) is a miscellaneous land type that consists of bars of mixed sand and gravel along streams. It is often overflowed during spring runoff. There is little vegetation, but sparse stands of weeds and willows that grow along the streambanks provide some protection from erosion. Yields of usable forage are negligible.

This land type is suited mainly to wildlife habitat. (Capability unit VIIIw–4, nonirrigated; not in a range site, a woodland suitability group, or a wildlife suitability group)

Rock Land

Rock land (RO) is a miscellaneous land type consisting of areas that contain enough rock outcrop and very shallow soil material to be dominant over other soil charac-

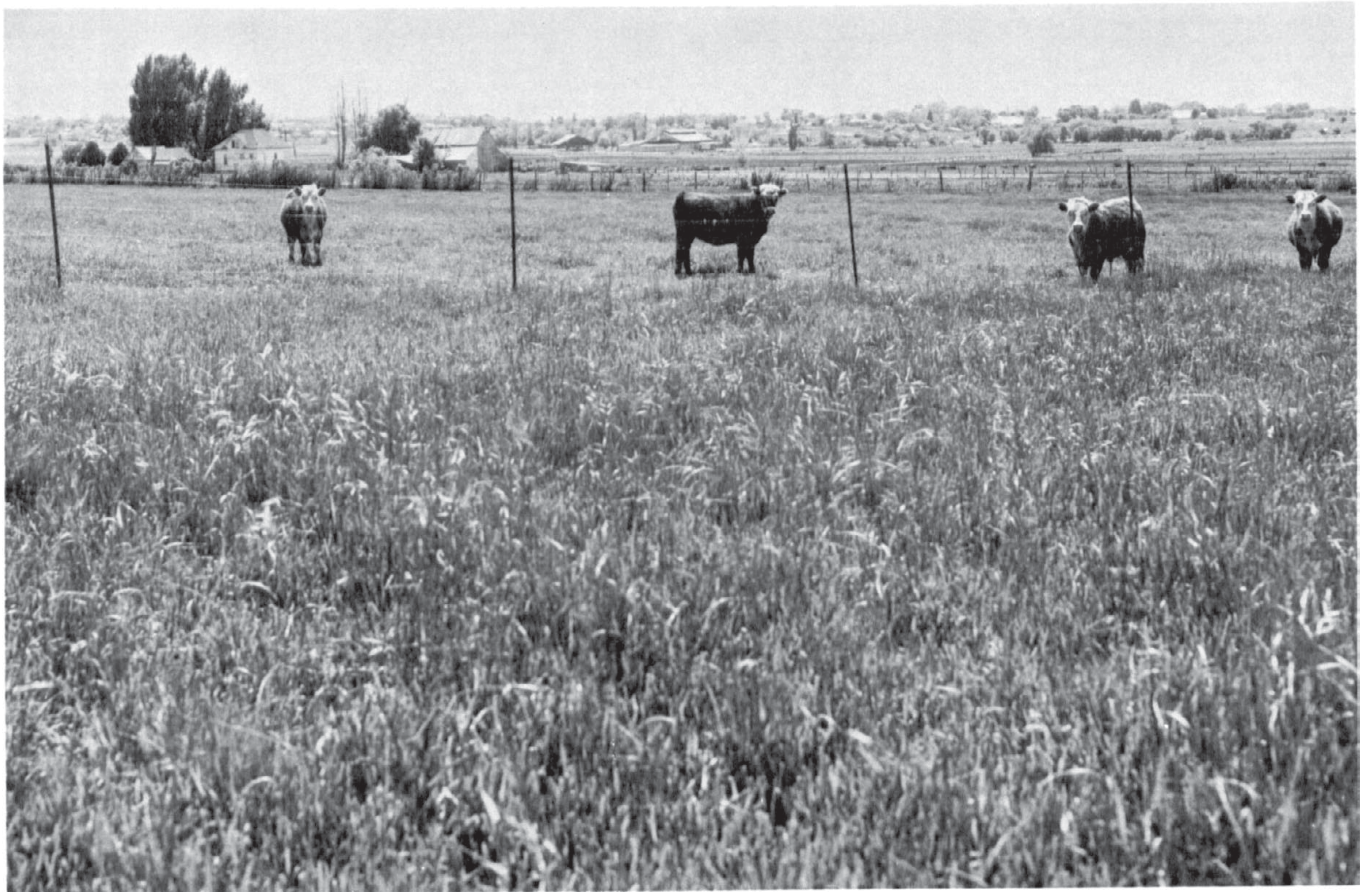

Figure 11.—**Irrigated pasture on Ricks gravelly loam, 6 to 10 percent slopes.**

teristics. It is made up of rock outcrop, talus material, and areas of extremely stony land on very steep mountain slopes, canyon walls, and ridges. The rocks are mainly limestone and quartzite but partly sandstone and conglomerate. The scattered vegetation is variable but includes bluebunch wheatgrass, maple, juniper, bitterbrush, big sagebrush, and some conifer and aspen trees.

Included with Rock land in mapping were areas of Agassiz soils.

The land type is used for watershed and wildlife. (Capability unit VIIIs–X; not in a range site, a woodland suitability group, or a wildlife suitability group)

Roshe Springs Series

The Roshe Springs series consists of poorly drained soils. These soils formed in mixed, very strongly calcareous alluvium under the influence of a high water table in depressional areas. They are on concave, low lake terraces and fans at elevations of 4,450 to 4,600 feet. Slopes range from 0 to 3 percent. The vegetation is sedges, wiregrass, Kentucky bluegrass, saltgrass, and bulrush. The average annual precipitation ranges from 14 to 17 inches. the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 140 days. Roshe Springs soils are associated with Logan, Greenson, Collett, Salt Lake, Provo, and Cardon soils.

In a representative profile, the soil is dark-gray to white, moderately alkaline, very strongly calcareous or strongly calcareous silt loam to a depth of 60 inches or more.

Roshe Springs soils generally are used for native pasture, but small drained areas are used for irrigated crops.

Roshe Springs silt loam (Rs).—This soil is in poorly drained depressions on low lake terraces and fans near the bottom of Cache Valley. Slopes range from 0 to 3 percent.

Representative profile in a native meadow, one-fourth mile east of the California Packing Company plant in Hyrum, 2,000 feet east of the southwest corner of sec. 33, T. 11 N., R. 1 E.:

O1—2 inches to 0, matted roots and plant material.

A1—0 to 8 inches, dark-gray (2.5Y 4/1) silt loam, very dark gray (2.5Y 3/1) when moist; weak, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; many medium roots and few large roots; few fine pores; moderately calcareous; moderately alkaline; clear, smooth boundary.

C1ca—8 to 14 inches, light-gray (5Y 7/1) silt loam, gray to light gray (5Y 6/1) when moist; massive; slightly hard, friable, slightly sticky and plastic; many fine and medium roots; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C2ca—14 to 23 inches, white (5Y 8/1) silt loam, light gray (5Y 7/1) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C3ca—23 to 35 inches, light-gray (5Y 7/1) silt loam, gray to light gray (5Y 6/1) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous; moderately alkaline; diffuse, wavy boundary.

C4—35 to 60 inches, light-gray (5Y 7/2) silt loam, light brownish gray (2.5Y 6/2) when moist; many, medium, prominent, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline.

A peaty horizon as much as 2 inches thick covers the A1 horizon in places. The A1 horizon is dominantly silt loam but is loam in places and is 8 to 15 inches thick. It ranges from dark gray to gray in a hue of 10YR or 2.5Y. The C horizon ranges from silt loam to light silty clay loam. In places the C horizon contains lime nodules and is weakly cemented. The Cca and C horizons have a hue of 2.5Y or 5Y. In places strata of sand and gravel are below a depth of 40 inches. Reaction is moderately alkaline to strongly alkaline.

This soil is moderately permeable. Runoff is slow, and the hazard of erosion is none to slight. If this soil is drained, it holds 8 to 10 inches of available water to a depth of 5 feet. The depth to the water table normally is 10 to 36 inches, but some areas are ponded part of the year. In some drained areas, the water table has been lowered a depth of 60 inches. Roots penetrate the soil easily.

Included in mapping were small areas of Logan silty clay loam and small ponded areas on which the vegetation is cattails and bulrushes.

The Roshe Springs soil is used mostly for range. About 25 percent of the acreage has been partially drained and is used for irrigated crops of small grain, corn for silage, improved pasture, and sugar beets. (Capability unit IIIw–2, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Rough Broken Land

Rough broken land (Rt) is a miscellaneous land type that consists of very steep areas on long escarpmentlike breaks into deep stream bottoms. The areas are broken by intermittent drainage channels. The vegetative cover is grass and shrubs. This land type is used mainly for wildlife habitat. Some areas are used for limited grazing. Runoff is very rapid, and soil slippage is common. Geologic erosion is active in many areas. Drainage from higher irrigated areas causes frequent seeps and wet spots along the breaks. These wet areas are used for limited grazing. (Capability unit VIIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

St. Marys Series

The St. Marys series consists of well-drained soils that have a very cobbly fine sandy loam subsoil. These soils formed in colluvium and residuum derived from sandstone, conglomerate, and quartzite. They are on convex south- and west-facing mountain slopes at elevations of 6,500 to 8,000 feet. Slopes range from 30 to 60 percent. The vegetation is bluebunch wheatgrass, Great Basin wildrye, big sagebrush, bitterbrush, and yellowbrush. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature is 36° to 44° F., and the frost-free season is 80 to 100 days. St. Marys soils are associated with Curtis Creek, Ant Flat, and Scave soils.

In a representative profile, the surface layer is brown to dark-brown, slightly acid gravelly very fine sandy loam about 16 inches thick. The subsoil is yellowish-red, neutral very cobbly fine sandy loam about 11 inches thick. The substratum is strong-brown, neutral very cobbly fine sandy loam, to a depth of 60 inches or more.

St. Marys soils are used for range, watershed, and wildlife habitat.

St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes (SAG).—This soil is on south- and west-facing mountain slopes near the Blake Hollow area east of Ant Valley.

Representative profile in an area of native vegetation, about 1,000 feet north and 100 feet west of the southeast corner of sec. 2, T. 8 N., R. 3 E.:

A11—0 to 9 inches, brown to dark-brown (7.5YR 4/2) gravelly fine sandy loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many fine and medium roots; 35 percent gravel; slightly acid; clear, wavy boundary.

A12—9 to 16 inches, brown (7.5YR 5/3) gravelly very fine sandy loam, dark brown (7.5YR 3/4) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many fine and medium roots; common, very fine, tubular pores; 40 percent gravel; slightly acid; gradual, irregular boundary.

B2—16 to 27 inches, yellowish-red (5YR 5/6) very cobbly fine sandy loam, yellowish red (5YR 4/6) when moist; very weak, fine, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; 70 percent cobblestones and gravel; neutral; abrupt, wavy boundary.

C—27 to 60 inches, strong-brown (7.5YR 5/6) very cobbly fine sandy loam, reddish brown (5YR 4/4) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; 85 percent cobblestones and gravel; moderately calcareous; neutral.

The A1 horizon ranges from brown or dark brown to reddish brown in hues of 7.5YR and 5YR. Texture is gravelly very fine sandy loam to gravelly light loam. Thickness ranges from 9 to 20 inches. The B2 horizon ranges from yellowish red to reddish brown, light reddish brown, or strong brown. Texture is very cobbly very fine sandy loam to very gravelly fine sandy loam or very cobbly light loam. Reaction ranges from slightly acid to mildly alkaline. The C horizon ranges from strong brown to reddish brown or light reddish brown in hues of 7.5YR and 5YR. Reaction ranges from neutral to moderately alkaline, and the horizon is noncalcareous to moderately calcareous. The combined thickness of the A1 and B2 horizons ranges from 24 to 32 inches. Bedrock is at a depth of 40 to 55 inches in places. The content of cobblestones and gravel generally increases with depth, ranging from 20 to 50 percent in the A horizon and from 50 to 80 percent in the B2 and C horizons.

Permeability is moderate to moderately rapid. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds about 4 to 5 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were areas of Curtis Creek loam, 30 to 60 percent slopes, and Goring silt loam, 6 to 30 percent slopes. The Curtis Creek soil makes up about 5 percent of the mapped areas, and the Goring soil about 2 percent.

This St. Marys soil is used for range, watershed, and wildlife habitat. (Capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

St. Marys-Curtis Creek association (30 to 60 percent slopes) (SCG).—This mapping unit is north and east of Hardware Ranch. About 65 percent of the association is St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes; 30 percent is Curtis Creek loam, 30 to 60 percent slopes; and about 5 percent is included small areas of Lucky Star gravelly silt loam, 30 to 60 percent slopes.

These soils are on dominantly south-facing mountain slopes. The St. Marys soil is commonly on the lower two-thirds of slopes, and the Curtis Creek soil is on the upper one-third of slopes and on spur ridges. The surface layer is 5 to 25 percent cobblestones and gravel and is 8 to 10 inches thick. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The vegetation is shrubs and grass.

Soils of this mapping unit are used for range, wildlife habitat, and watershed. (St. Marys soil is in capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site. Curtis Creek soil is in capability unit VIIs-MX3, nonirrigated; Mountain Shallow Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 3)

Salt Lake Series

The Salt Lake series consists of poorly drained and very poorly drained soils that formed in very strongly calcareous, mixed lake sediment derived from limestone and quartzite. These soils are on low lake terraces at elevations of 4,420 to 4,470 feet. Slopes are 0 to 1 percent. The vegetation is sedges, cattails, bulrush, foxtail, and saltgrass. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Salt Lake soils are associated with Logan, Roshe Springs, Airport, Trenton, Cardon, and Greenson soils.

In a representative profile, the soil is very dark gray to light-gray and light brownish-gray, mildly alkaline to strongly alkaline silty clay that extends to a depth of 60 inches or more.

Salt Lake soils are used mostly for range or for meadow hay.

Salt Lake silty clay (Se).—This soil is in smooth areas or in slightly concave depressions on low lake terraces in the central part of Cache Valley. The slopes are dominantly less than 1 percent.

Representative profile in a meadow, 2½ miles south of Benson, 1,000 feet north and 200 feet east of the southwest corner of the southeast quarter of sec. 23, T. 12 N., R. 1 W.:

O1—2 inches to 0, matted roots and plant material.

A1—0 to 7 inches, very dark gray (10YR 3/1) silty clay, black (10YR 2/1) when moist; weak, medium, granular structure; very hard, firm, slightly sticky and plastic; many fine and medium roots; few fine pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

ACcag—7 to 15 inches, gray (2.5Y 5/1) silty clay, very dark gray (2.5Y 3/1) when moist; weak, coarse, subangular blocky structure; very hard, very firm, sticky and plastic; common fine, medium, and large roots; few medium pores; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C1cag—15 to 36 inches, gray to light-gray (2.5Y 6/1) silty clay, gray (2.5Y 5/1) when moist; massive; very hard, very firm, sticky and plastic; few fine roots and common medium roots; very strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2—36 to 66 inches, light brownish-gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; extremely hard, very firm, sticky and very plastic; few medium roots; common fine pores; strongly calcareous; strongly alkaline.

A peaty horizon, 1 to 4 inches thick, commonly overlies the A1 horizon. The A1 horizon ranges from very dark gray to gray in hues of 10YR and 2.5Y. Texture ranges from silty clay to heavy silty clay loam. Reaction is mildly alkaline to moderately alkaline. Thickness ranges from 6 to 16 inches. The Cca and C horizons range from gray or light gray to light brownish gray or white in a hue of 10YR, 2.5Y, or 5Y. Texture is silty clay to clay. Generally, the exchangeable sodium percentage is less than 15 in the A horizon and increases with depth to 15 to 35 below a depth of 20 inches. Depth to the horizon of carbonate accumulation ranges from 6 to 15 inches. In places the C1cag horizon is weakly cemented. The water table fluctuates from the surface to a depth of 30 inches in undrained areas, but it is at a depth of more than 60 inches in drained areas.

This soil is very slowly permeable. Runoff is very slow to ponded, and the hazard of erosion is slight to none. If the soil is drained, it holds about 10 inches of available water to a depth of 5 feet. Roots penetrate to the water table.

Included in mapping were small areas of soils that are affected by salt and alkali.

This soil is used mostly for meadow pasture and hay. (Capability unit Vw-2, nonirrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Salt Lake silty clay loam (Sd).—This soil is on low lake terraces about 6 miles southwest of the city of Logan. It is similar to Salt Lake silty clay, except that it has a surface layer of silty clay loam and a strong horizon of gypsum accumulation at a depth of about 30 inches. The surface layer ranges from 7 to 14 inches in thickness. The depth to the water table is mostly 36 to 45 inches, but it ranges to as much as 60 inches where the soil is drained. The depth to distinct mottles ranges from 13 to 30 inches. The content of calcium sulfate in the lower part of the substratum is 6 to 12 percent.

This soil is moderately difficult to till. It compacts if worked when too wet. It is poorly drained, and permeability is slow. If this soil is drained, it holds 10 to 12 inches of available water to a depth of 5 feet. Runoff is slow, and the hazard of erosion is slight. Roots penetrate to a depth of 3 to 4 feet.

Included in mapping were small areas of soils that have slopes of 1 to 3 percent and small areas of Salt

Lake silty clay. Also included were small areas of soil that are slightly affected by salt and alkali.

Most areas of this soil are artificially drained and are used for irrigated crops of alfalfa, small grain, sugar beets, corn for silage, and improved pasture. (Capability unit IIIw-25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Salt Lake-Logan complex (Sf).—This complex is in lowlying areas on low lake terraces, mainly in an area 2 miles northeast of the community of Young Ward. In these areas the topography is undulating. About 50 percent of the complex is Salt Lake silty clay loam, and about 50 percent is Logan silty clay loam. The Salt Lake soil is on slightly elevated mounds, and the Logan soil is in lower, poorly drained depressions surrounding the mounds. Slopes generally are less than 1 percent.

The Salt Lake soil is similar to Salt Lake silty clay, except that it has a surface layer of silty clay loam, about 8 inches thick, and a horizon of gypsum accumulation at a depth of about 30 inches. The surface layer ranges from 7 to 14 inches in thickness. The depth to the water table is mainly 36 to 45 inches but ranges to as much as 60 inches in drained areas. The depth to distinct mottles ranges from 13 to 30 inches. The calcium sulfate percentage in the lower part of the substratum ranges from 6 to 12.

The Salt Lake soil is moderately difficult to till. It compacts if worked when too wet. It is poorly drained, and its permeability is slow. If this soil is drained, it holds 10 to 12 inches of available water to a depth of 5 feet. Runoff is slow, and the hazard of erosion is slight. Roots penetrate to a depth of 3 to 4 feet.

The Logan soil is similar to Logan silty clay loam, which is described under the Logan series.

Soils of this mapping unit are mostly used for range. A small acreage has been drained and leveled and is used for irrigated crops of small grain, sugar beets, and improved pasture. (Capability unit IIIw-25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Salt Lake-Roshe Springs complex (Sg).—This complex is mainly in an area east of the city of Mendon. About 60 percent of the complex is Salt Lake silty clay, and 40 percent is Roshe Springs silt loam.

The Salt Lake soil is in channels and swales. It is poorly drained and slowly permeable. Runoff is slow, and the hazard of erosion is slight.

The Roshe Springs soil is on mounds. It is similar to Roshe Springs silt loam, described under the Roshe Springs series, except that it has a slowly permeable substratum and commonly is slightly or moderately affected by salt and alkali.

Included in mapping were small areas of Airport silty clay loam.

Soils of this mapping unit are used for range and wildlife habitat. (Capability unit Vw-2, nonirrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Salt Lake-Trenton complex (Sh).—This complex is in a few rather large areas on low lake terraces north of Valley View Highway and Benson Road Junction. About 60 percent of the complex is Salt Lake silty clay, and about 40 percent is Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes.

The Salt Lake soil generally is in depressions, where runoff is very slow to ponded. The Trenton soil is on slightly raised knolls, where runoff is slow. Many areas have been rough leveled, however, and no topographic separation of the two soils can be observed. The hazard of erosion is slight.

Included in mapping were small areas of Logan silty clay loam and small areas of a soil that has slopes of 2 to 3 percent.

Soils of this mapping unit are used mainly for range and meadow hay. A small acreage is in improved pasture. (Both soils in capability unit Vw-2, nonirrigated; Salt Lake soil, Wet Meadow range site. Trenton soil, Alkali Bottom range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 1)

Scave Series

The Scave series consists of well-drained soils that have a very cobbly clay subsoil. These soils formed in residuum and colluvium derived from sandstone, shale, and quartzite rocks. They are on mountain slopes at elevations of 6,200 to 7,500 feet. Slopes range from 10 to 30 percent. The vegetation is aspen and scattered Douglas-fir and an understory of snowberry, mountain brome, blue wildrye, oniongrass, slender wheatgrass, and peavine. The average annual precipitation ranges from 20 to 30 inches, the mean annual temperature is 36° to 42° F., and the mean soil temperature in summer is less than 59°. The frost-free season is 80 to 100 days. Scave soils are associated with Lucky Star, Ant Flat, Hoskin, and Despain soils.

In a representative profile, the surface layer is dark-brown and brown, medium acid silt loam about 16 inches thick. The subsurface layer is brown, slightly acid cobbly loam about 18 inches thick. The subsoil is reddish-brown, medium acid very cobbly clay to a depth of 60 inches or more.

Scave soils are used for range, woodland, watershed, and wildlife habitat.

Scave silt loam, 10 to 30 percent slopes (SlE).—This soil is on east- and north-facing mountain slopes surrounding Ant Flat south of Hardware Ranch.

Representative profile, 1½ miles south and 2 miles west of Anderson Ranch headquarters, about 1,000 feet north of the center of sec. 9, T. 9 N., R. 3 E.:

O1—2 inches to 0, matted decaying leaves and twigs.

A1—0 to 10 inches, dark-brown (7.5YR 4/2) silt loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many large and medium roots; few fine interstitial pores; 5 percent gravel; medium acid; gradual, wavy boundary.

A1&A2—10 to 16 inches, dark-brown (7.5YR 4/3) and brown (7.5YR 5/4) silt loam, very dark brown (7.5YR 2/2) and dark brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many large, medium, and small roots; few fine interstitial pores; 15 percent gravel; medium acid; gradual, wavy boundary.

A2—16 to 34 inches, brown (7.5YR 5/4) cobbly loam, brown to dark brown (7.5YR 4/4) when moist; weak, medium and coarse, subangular blocky structure;

soft, very friable, nonsticky and nonplastic; common medium and small roots; many medium and fine interstitial pores; 30 to 40 percent cobblestones and gravel; slightly acid; abrupt, smooth boundary.

B21t—34 to 46 inches, reddish-brown (2.5YR 5/4) very cobbly clay, red (2.5YR 4/6) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; many medium and fine tubular pores; moderately thick continuous clay films; 60 percent cobblestones; medium acid; few, fine, black concretions and stains; gradual, wavy boundary.

B22t—46 to 60 inches, same as B21t horizon, but has 80 to 90 percent cobblestones and a few stones.

The combined thickness of the A1, A2, and B2t horizons ranges from 50 to more than 75 inches. Coarse fragments are mostly cobblestone- and stone-size angular sandstone. Their content ranges from 5 to 20 percent in the A1 horizon, from 30 to 70 percent in the A2 horizon, from 50 to 70 percent in the upper part of the B2t horizon, and from 70 to 90 percent in the lower part of the B2t horizon. The A1 horizon ranges from dark brown to brown in hues of 10YR and 7.5YR. Texture is silt loam to gravelly silt loam. Reaction ranges from medium acid to neutral. Thickness ranges from 10 to 16 inches. The A2 horizon ranges from brown to light brown or reddish brown in a hue of 10YR, 7.5YR, or 5YR. Texture ranges from cobbly loam or very cobbly loam to gravelly fine sandy loam. Reaction is medium acid to slightly acid. Thickness ranges from 10 to 24 inches. The B2t horizon ranges from reddish brown or red to yellowish red or light reddish brown in hues of 5YR and 2.5YR. Texture ranges from very cobbly clay to very cobbly heavy clay loam.

Permeability is slow. Runoff is medium, and the hazard of erosion is moderate. The soil holds 5 to 7 inches of available water in a 5 foot depth. Roots penetrate to depths of 5 feet or more.

Included in mapping were small areas of Lucky Star silt loam, 6 to 30 percent slopes, and areas of Ant Flat loam, 6 to 20 percent slopes.

This Scave soil is used for range, watershed, and wildlife habitat. It is suited to aspen, but few aspen are used except for firewood. (Capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Scave extremely rocky silt loam, 10 to 30 percent slopes (SKE).—This mapping unit is near the Weber County line west of James Peak. About 60 percent of the mapping unit is Scave stony silt loam, 10 to 30 percent slopes; 30 percent is Rock land and rock outcrop; and 10 percent is included soils.

The Scave soil is similar to Scave silt loam, 10 to 30 percent slopes, except that it has 10 to 30 percent gravel and cobblestones and about 10 percent stones on the surface and in the surface layer. Large stones are scattered throughout the profile. The depth to the horizon of clay accumulation ranges from 28 to 32 inches. The vegetation is oakbrush, slender wheatgrass, and big sagebrush.

Rock land and rock outcrop are intermingled with areas of the Scave soil. They consist of quartzite rock.

Included in mapping were areas of Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded, and areas of steeper soils.

This mapping unit is used for range, watershed, and wildlife habitat. (Capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; not in a woodland suitability group; wildlife suitability group 4)

Scout Series

The Scout series consists of somewhat excessively drained soils that have a very gravelly fine sandy loam subsoil. These soils formed in residuum and till material derived from sandstone conglomerate and quartzite rocks. They are on mountain slopes at elevations of 7,200 to 8,500 feet. Slopes range from 10 to 70 percent. The vegetation is Douglas-fir, alpine fir, Engelmann spruce, and aspen. The average annual precipitation ranges from 25 to 35 inches, the mean annual air temperature is 36° to 40° F., and the mean soil temperature in summer is less than 59°. The frost-free season is 60 to 90 days. Scout soils are associated with Cluff, Curtis Creek, Hoskin, and Lucky Star soils.

In a representative profile, the surface layer is pale-brown, slightly acid gravelly light loam about 4 inches thick. The subsurface layer is pink or pinkish-gray, slightly acid gravelly light loam or gravelly fine sandy loam about 14 inches thick. The subsoil is light reddish-brown to reddish-yellow, medium acid to strongly acid gravelly fine sandy loam and very gravelly sandy loam to a depth of 60 inches or more.

Representative profile of Scout gravelly loam, 10 to 40 percent slopes, in an area of Cluff-Scout association, 6 to 40 percent slopes, about 1.6 miles east of Baxter Sawmill near the west quarter corner of sec. 36, T. 11 N., R. 4 E.:

O1&O2—2 inches to 0, coarse needles and conifer branches over dark, soft humus layers.

A1—0 to 4 inches, pale-brown (10YR 6/3) gravelly light loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; loose, very friable, nonsticky and slightly plastic; many fine, medium, and large roots; 20 percent gravel; slightly acid; abrupt, wavy boundary.

A21—4 to 11 inches, pinkish-gray (7.5YR 6/2) gravelly light loam, dark yellowish brown (10YR 3/4) when moist; weak, coarse, subangular structure that parts to fine granular structure; slightly hard, friable, nonsticky and slightly plastic; many fine, medium, and large roots; many, very fine, discontinuous, random and interstitial pores; 20 percent gravel; slightly acid; clear, wavy boundary.

A22—11 to 18 inches, pink (7.5YR 7/4) gravelly fine sandy loam, brown (7.5YR 4/4) when moist; weak, coarse, subangular blocky structure that parts to fine granular structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots and few large roots; many, very fine, discontinuous, random, interstitial pores; 25 percent gravel; medium acid; abrupt, wavy boundary.

B21—18 to 32 inches, light reddish-brown (5YR 6/4) very gravelly fine sandy loam, reddish brown (5YR 4/4) when moist; massive; loose dry and moist, nonsticky and nonplastic; common fine and medium roots and few large roots; 50 percent gravel; medium acid; abrupt, wavy boundary.

B22—32 to 62 inches, reddish-yellow (5YR 6/6) very gravelly sandy loam, yellowish red (5YR 5/8) when moist; single grain; loose dry and moist, nonsticky and nonplastic; few fine, medium, and large roots; 65 percent gravel; strongly acid.

The combined thickness of the A1, A2, and B2 horizons ranges from 30 to more than 72 inches. Coarse fragments consist of well-graded angular gravel, cobblestones, and stone-size quartzite and sandstone. Their content ranges from 15 to 50 percent in the A1 and A2 horizons and from 35 to 75 percent in the B2 horizon. The A1 horizon ranges from pale brown or brown to light brown in a hue of 10YR or 7.5YR. Texture is gravelly loam to gravelly silt loam. Reaction ranges from neutral to strongly acid. Thickness ranges from 0 to 5 inches. The A2 horizon ranges from pink or pinkish gray to pale brown or light brown in a hue of 10YR or 7.5YR. Texture ranges from gravelly light loam to gravelly fine sandy loam. Reaction ranges from strongly acid to slightly acid. Thickness ranges from 10 to 22 inches. The B2 horizon ranges from light reddish brown or reddish yellow to light brown in hues of 7.5YR and 5YR. Texture ranges from very gravelly sandy loam to very gravelly very fine sandy loam. Reaction ranges from strongly acid to slightly acid.

The permeability is moderately rapid. Runoff is medium to rapid, and the hazard of erosion is moderate to high. These soils hold 4 to 5 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Scout soils are used for woodland, range, watershed, and wildlife habitat.

In this survey area, the Scout soils are mapped only in associations with Cluff and Lucky Star soils.

Scout gravelly loam, 40 to 70 percent slopes (SLG).—This soil is on the mountain slopes in the Franklin Basin and Hyrum Dry Canyon areas. It is similar to Scout gravelly loam, 10 to 40 percent slopes, but it is steeper, it formed in parent material more influenced by quartzite rocks, and its colors are slightly more brown with hues of 7.5YR and 10YR. Quartzite bedrock is at a depth of 40 to 55 inches.

Included in mapping were small areas of Lucky Star gravelly silt loam, 30 to 60 percent slopes, small areas of Fitzgerald extremely stony loam, and small areas of very stony sand.

This Scout soil is used for woodland, wildlife habitat, watershed, and range. (Capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Shay Series

The Shay series consists of nearly level, somewhat poorly drained soils that have a silty clay subsoil. These soils formed in mixed calcareous alluvium derived from limestone, sandstone, and quartzite rocks. They are on flood plains of the Little Bear and Cub Rivers at elevations of 4,420 to 4,450 feet. Slopes range from 0 to 1 percent. The vegetation is saltgrass, Kentucky bluegrass, foxtail, and sedges. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 130 days. Shay soils are associated with Kirkham and Winn soils.

In a representative profile, the surface layer is dark-gray, mildly alkaline silty clay loam about 14 inches thick. The next layer is dark-gray, mildly alkaline silty clay about 16 inches thick. Below this is gray, moderately alkaline, highly stratified loam and sandy loam to a depth of 58 inches.

Shay soils are used mostly for irrigated crops and meadow pasture.

Shay silty clay loam (Sm).—This soil is mainly on the flood plains of the Little Bear and Cub Rivers. It has slopes of less than 1 percent.

Representative profile in a cultivated field, 1 mile north and ½ mile east of the Sego Milk Plant, Wellsville, 1,100 feet south and 1,200 feet east of the northeast corner of the southeast quarter of sec. 26, T. 11 N., R. 1 W.:

Ap—0 to 14 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) when moist; weak, coarse, subangular blocky structure grading to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; many medium and large roots; common fine and medium pores; moderately calcareous; mildly alkaline; clear, smooth boundary.

IIC1—14 to 30 inches, dark-gray (10YR 4/1) silty clay, black (10YR 2/1) when moist; moderate, coarse, subangular blocky structure grading to strong, fine, subangular blocky structure; very hard, very firm, sticky and plastic; common fine and medium roots; moderately calcareous; mildly alkaline; clear, smooth boundary.

IIIC2—30 to 44 inches, gray (2.5Y 5/1) loam, very dark gray (2.5Y 3/1) when moist; massive; slightly hard, friable, slightly sticky and plastic; common fine and medium roots; many fine and medium pores; moderately calcareous; mildly alkaline; clear, smooth boundary.

IVC3—44 to 58 inches, gray (2.5Y 5/1) sandy loam, very dark gray (2.5Y 3/1) when moist; massive; slightly hard, very friable, nonsticky and slightly plastic; strongly calcareous; moderately alkaline.

VC4—58 to 60 inches, coarse sand and gravel.

The A1 horizon ranges from dark gray to gray. Texture ranges from silty clay loam to light silty clay. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. The calcium carbonate equivalent ranges from 10 to 40 percent. Thickness ranges from 7 to 14 inches. The C horizon ranges from gray or very dark gray to grayish brown. Texture ranges from silty clay to heavy silty clay loam. The lower part of the C horizon is highly stratified and ranges from silt loam to sandy loam. Loamy fine sand, coarse sand, and gravel occur below a depth of 40 inches in places. Reaction ranges from mildly alkaline to strongly alkaline, and the horizon is moderately or strongly calcareous. Few faint to many, fine, distinct, reddish-brown mottles occur in the lower part of the C horizon below a depth of 30 inches in some profiles.

This soil is difficult to till, and it compacts if worked when wet. Runoff is slow, and the hazard of erosion is slight. Permeability is slow. When this soil is not frozen, it is saturated within a depth of 40 inches unless it is artificially drained. If the soil is drained, it holds 8 to 10 inches of available water to a depth of 5 feet. The depth to the water table is generally 30 to 50 inches. Roots penetrate to the water table or to the gravelly horizon.

Included in mapping were small areas of Winn silt loam and Kirkham silt loam. Also included were areas of poorly drained, sandy soils in old shallow oxbows.

This soil is used mostly for range. Only about 15 percent of the acreage is cultivated. Principal crops are small grain, alfalfa, sugar beets, corn for silage, and improved pasture. (Capability unit IIIw–25, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Sheep Creek Series

The Sheep Creek series consists of well-drained soils that have a very cobbly clay loam subsoil. Bedrock is at a depth of 20 to 40 inches. These soils formed in residuum and colluvium derived from limestone, calcareous sandstone, and quartzite. They are on south- and west-facing, slightly convex mountain slopes at elevations of 5,500 to 6,500 feet. Slopes range from 30 to 70 percent.

The vegetation is bluebunch wheatgrass, tall native bluegrass, Sandberg bluegrass, big sagebrush, bitterbrush, and yellowbrush. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature is 39° to 44° F., and the frost-free season is 90 to 100 days. Sheep Creek soils are associated with Smarts, Agassiz, Datwyler, Bickmore, Picayune, and Despain soils.

In a representative profile, the surface layer is brown, neutral cobbly loam about 7 inches thick. The subsoil is brown, neutral very cobbly light clay loam about 8 inches thick. The substratum is brown, mildly alkaline very cobbly loam about 13 inches thick. Fractured limestone is at a depth of 28 inches.

Sheep Creek soils are used for range, watershed, and wildlife habitat.

Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded (SNG2).—This soil is on the south- and west-facing, slightly convex mountain slopes in the Upper Little Bear River and Sheep Creek drainage areas above Anderson's Ranch.

Representative profile, in Three Mile Canyon south of Avon, about 1,200 feet north and 400 feet west of the southeast corner of sec. 5, T. 8 N., R. 1 E.:

A1—0 to 7 inches, brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium and large roots; few, very fine, discontinuous, interstitial pores; 30 to 40 percent cobblestones; neutral; clear, smooth boundary.

B2t—7 to 15 inches, brown (7.5YR 5/3) very cobbly light clay loam, dark brown (7.5YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine and fine roots and few medium and large roots; common thin clay films in pores and on ped faces; 50 to 60 percent cobblestones; neutral; clear, smooth boundary.

Cca—15 to 28 inches, brown (10YR 5/3) very cobbly light loam, dark brown to brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; few, very fine, discontinuous, interstitial pores; 60 to 70 percent cobblestones; strongly calcareous; mildly alkaline; gradual, irregular boundary.

R—28 inches, fractured limestone bedrock that has brown very cobbly loam in cracks.

The combined thickness of the A1 and B2t horizons over the horizon of carbonate accumulation ranges from 13 to 22 inches. The depth to fractured limestone bedrock ranges from 20 to 40 inches. Coarse fragments are mainly cobblestone- and gravel-size, rounded limestone and calcareous sandstone rock fragments. Their content ranges from 15 to 50 percent in the A1 horizon and from 50 to 70 percent in the B2t horizon. The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Texture is cobbly loam or gravelly loam to cobbly silt loam. Reaction is neutral to mildly alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness ranges from 6 to 12 inches. The B2t horizon ranges from brown to dark brown or yellowish brown in hues of 10YR and 7.5YR. Texture ranges from very cobbly clay loam to very cobbly loam or very cobbly silt loam. Reaction ranges from neutral to moderately alkaline, and the horizon is generally noncalcareous but is slightly calcareous in the lower part. Thickness ranges from 6 to 18 inches. The Cca horizon ranges from brown or light brown to reddish brown in hues of 10YR, 7.5YR, and 5YR. Texture ranges from very cobbly loam to very cobbly/light clay loam or to very cobbly fine sandy loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is strongly to moderately calcareous.

Permeability is moderate. Runoff is rapid to very rapid, the hazard of erosion is high to very high, and this soil is moderately eroded. It holds 4 to 5 inches of available water above the bedrock. Rooting depth is 20 to 40 inches, but roots extend into cracks in the bedrock.

Included in mapping were small areas of Datwyler cobbly silty clay loam; Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and Despain gravelly loam, 30 to 70 percent slopes.

This Sheep Creek soil is used for range, watershed, and wildlife habitat. (Capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Sheep Creek-Agassiz association, eroded (30 to 70 percent slopes) (SOG2).—This mapping unit is in the vicinity of Dry Lake southwest of Wellsville and on the Clarkston Mountains. About 40 percent of the association is Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded; 30 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and 30 percent is included soils.

These steep and very steep soils are on south- and west-facing mountain slopes. The Sheep Creek soil is on the lower part of slopes, where the vegetation is grass and shrubs. The Agassiz soil is on convex ridges and the upper part of slopes.

Included in mapping were areas of Datwyler cobbly silt loam, 30 to 60 percent slopes, Picayune cobbly loam, 50 to 80 percent slopes, and Maughan silt loam, 30 to 60 percent slopes. Each of these soils makes up about 10 percent of the association. The Datwyler soil is in slightly concave areas, dominantly on the lower part of the slopes. The vegetation is grass and shrubs.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Sheep Creek soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. Neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

Sheep Creek-Despain association, eroded (30 to 70 percent slopes) (SPG2).—This mapping unit is on the eastern foothills of Clarkston Mountain. About 40 percent of the association is Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded; 30 percent is Despain gravelly loam, 30 to 70 percent slopes; and 30 percent is included soils.

The steep and very steep Sheep Creek soil has south-facing slopes. The vegetation is sagebrush and grass.

The Despain soil has short north-facing slopes. The vegetation is ninebark, snowberry, and other brush.

Included in mapping were areas of Agassiz rocky silt loam, 30 to 70 percent slopes, Bickmore gravelly silt loam, 30 to 70 percent slopes, and Elzinga silt loam, 30 to 60 percent slopes. The Agassiz soil makes up 20 percent of the association, and the Bickmore and Elzinga soils each makes up about 5 percent.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Sheep Creek soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Despain soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

Sheep Creek-Maughan association, eroded (30 to 70 percent slopes) (SRG2).—This mapping unit is west and south of Avon, east of the mountain divide. About 50 percent of the association is Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded; about 35 percent is Maughan silt loam, 30 to 60 percent slopes; and about 15 percent is included soils.

The steep and very steep Sheep Creek soil is on south-facing mountain slopes. The vegetation is sagebrush, forbs, and grass.

The steep and very steep Maughan soil is on north- and east-facing mountain slopes. The vegetation is scrubby maple, chokecherry, and an understory of forbs and grass.

Included in mapping were areas of Goring silt loam, 6 to 30 percent slopes, eroded, and Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes. The Goring soil makes up 10 percent of the association, and the Yeates Hollow soil 5 percent.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Sheep Creek soil is in capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site. Maughan soil is in capability unit VIIe-MN, nonirrigated; Mountain Loam (Shrubs) range site. Neither is in a woodland suitability group; both soils are in wildlife suitability group 3)

Smarts Series

The Smarts series consists of well-drained soils that have a very cobbly loam subsoil. These soils have formed in alluvium and colluvium derived chiefly from sandstone, quartzite, and limestone. They are on alluvial-colluvial fans and in narrow drainageways at elevations of 5,200 to 9,000 feet. Slopes range from 10 to 30 percent. The vegetation is maple, chokecherry, scattered aspen, snowberry, big sagebrush, peavine, blue wildrye, slender wheatgrass, and bearded wheatgrass. The average annual precipitation ranges from 20 to 30 inches, the mean annual air temperature is 38° to 45° F., and the frost-free season is 80 to 110 days. Smarts soils are associated with Bickmore, Lucky Star, Despain, Elzinga, and Poleline soils.

In a representative profile, the surface layer is very dark grayish-brown, neutral silt loam and gravelly silt loam about 22 inches thick. The subsoil is brown, slightly acid very cobbly heavy loam about 27 inches thick. The substratum is brown, neutral very cobbly loam to a depth of 60 inches or more.

Smarts soils are used mainly for watershed, wildlife habitat, and limited grazing. Small areas are cultivated and are used for dryfarmed crops of alfalfa and small grain (fig. 12).

Smarts silt loam, 10 to 30 percent slopes (SSE).—This soil is on concave fans and alluvial drainage bottoms along the eastern foot slopes of the Wellsville Mountains.

Representative profile, in an area of native vegetation southwest of Mendon, 200 feet south and 200 feet west of the east quarter corner of sec. 19, T. 11 N., R. 1 W.:

O1—2½ inches to 0, undecomposed and partially decomposed maple leaves and twigs.

A11—0 to 15 inches, very dark grayish-brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure that parts to very fine granular structure; soft, friable, nonsticky and slightly plastic; many very fine roots and common coarse roots; 10 percent angular gravel; neutral; clear, smooth boundary.

A12—15 to 22 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, medium to coarse, subangular blocky structure that parts to weak, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; common very fine and coarse roots; 35 percent angular cobblestones and gravel; neutral; clear, wavy boundary.

B21t—22 to 49 inches, brown (10YR 5/3) very cobbly heavy loam, dark brown (10YR 4/3) when moist; weak and moderate, medium and coarse, subangular blocky structure that parts to moderate, fine, subangular blocky structure; slightly hard, friable, sticky and plastic; common thin clay films on ped faces and in pores; common very fine to coarse roots; common very fine pores; 70 percent angular cobblestones and gravel; slightly acid; gradual, wavy boundary.

C—49 to 60 inches, brown (10YR 5/3) very cobbly loam, dark brown to brown (10YR 4/3) when moist; weak, medium, subangular blocky structure that parts to very fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common medium roots; common very fine pores; 70 percent angular cobblestones and gravel; neutral.

The A1 horizon ranges from very dark grayish brown to dark grayish brown. Texture is silt loam or loam to gravelly silt loam or gravelly loam. Reaction is neutral to slightly acid. Thickness ranges from 16 to 34 inches. The B2t horizon ranges from brown to dark brown or yellowish brown in a hue of 10YR or 7.5YR. Texture ranges from very cobbly heavy loam to very cobbly light clay loam, and thin clay films are few to common on peds and in pores. Thickness ranges from 20 to 32 inches. The C horizon ranges from brown to pale brown or grayish brown in a hue of 10YR or 7.5YR. Texture ranges from very cobbly loam to very cobbly sandy loam.

Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds about 7.5 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet or more.

This soil is used mainly for watershed, wildlife habitat, and range. Small areas are used for nonirrigated small grain and alfalfa. (Capability unit VIe-M, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3)

Smarts-Hoskin association, eroded (30 to 70 percent slopes) (STG2).—This mapping unit is on the lower part of the eastern slopes of Wellsville Mountain. About 50 percent of the association is Smarts gravelly loam, 30 to 70 percent slopes; 40 percent is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; and about 10 percent is rock outcrop. Elevations range from 5,200 to 7,000 feet.

The Smarts soil is on north- and northeast-facing mountain slopes. The surface layer is 20 to 30 percent gravel and is 16 to 25 inches thick. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The vegetation is maple, ninebark, snowberry, pachistima, and grass.

The Hoskin soil is on south-facing mountain slopes. These are dominantly 60 to 70 percent. The surface layer is gravelly loam and contains less cobblestones than that of other Hoskin soils. The vegetation is sagebrush, forbs, and grass.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Smarts soil is in capability unit VIIe-MN, nonirrigated; Mountain Loam (Shrubs) range site. Hoskin soil is in capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site. Neither

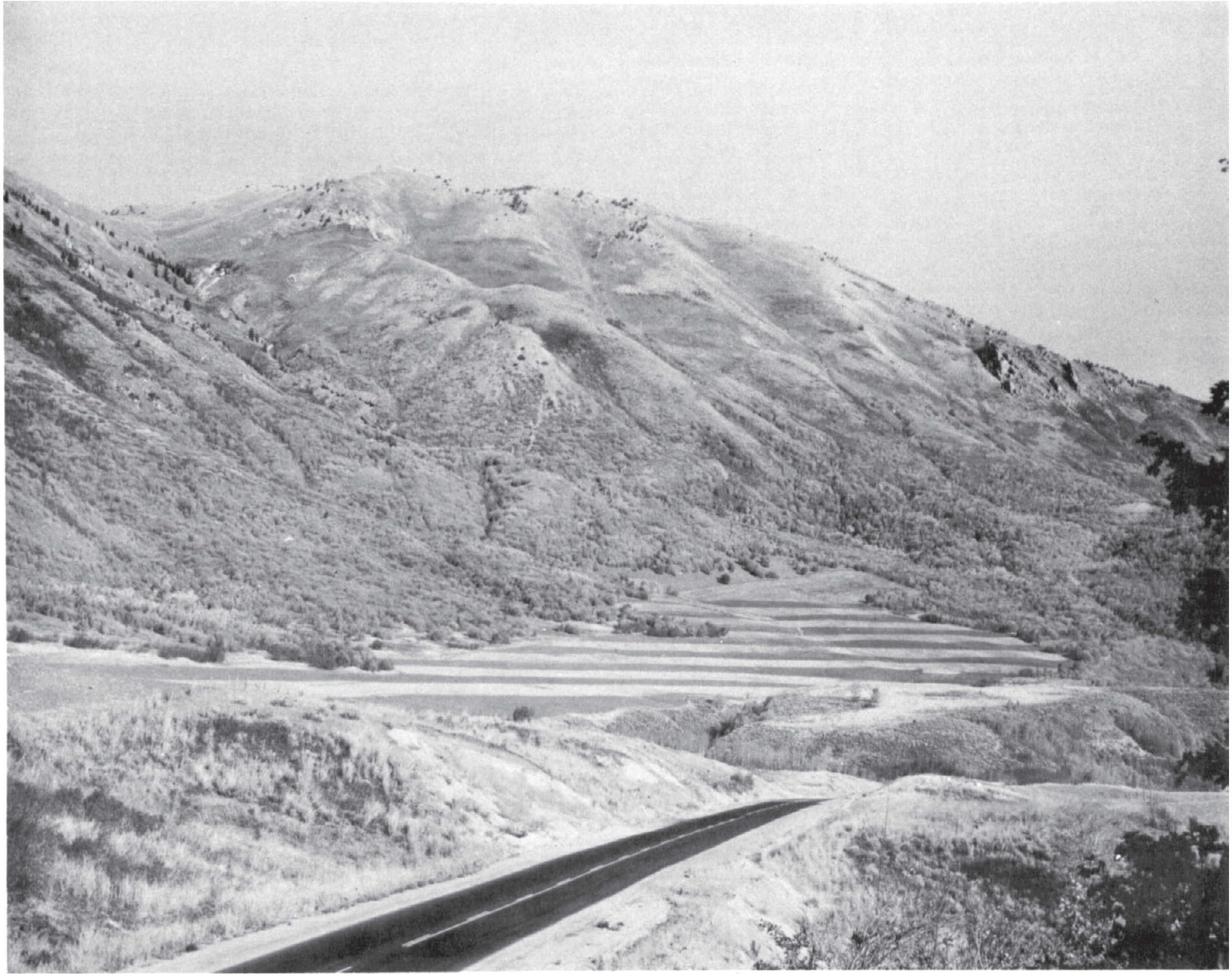

Figure 12.—Stripcropping on Smarts silt loam, 10 to 30 percent slopes. This area is in Wellsville Canyon. Wellsville Mountains are in the background.

soil is in a woodland suitability group; both are in wildlife suitability group 3)

Smarts-Lucky Star-Poleline association (30 to 70 percent slopes) (SUG).—This mapping unit is on the upper part of east-facing slopes of Wellsville Mountain. About 40 percent of the association is Smarts gravelly silt loam, 30 to 70 percent slopes; 25 percent is Lucky Star gravelly loam, 30 to 60 percent slopes; 20 percent is Poleline gravelly loam, 30 to 70 percent slopes; about 5 percent is rock outcrop; and 10 percent is included soils. Elevations range from 7,000 to 8,000 feet.

The Smarts soil has north-facing slopes. The surface layer is 20 to 30 percent gravel and is 16 to 25 inches thick. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The vegetation is maple.

The Lucky Star soil is in north-facing, concave areas at the heads of drainageways. The vegetation is apsen.

The Poleline soil is adjacent to drainageways. The vegetation is brush and shrubs.

Included in mapping were areas of Dateman cobbly silt loam, 40 to 70 percent slopes, and Agassiz silt loam, 30 to 70 percent slopes. The Dateman soil makes up 7 percent of the association, and the Agassiz soil 3 percent.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Smarts soil is in capability unit VIIe-MN, nonirrigated; Mountain Loam (Shrubs) range site. Lucky Star soil is in capability unit VIIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2rl. Poleline soil is in capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site. Neither the Smarts soil nor the Poleline soil is in a woodland suitability group; Smarts and Poleline soils are in wildlife suitability group 3, Lucky Star soil is in wildlife suitability group 4)

Steed Series

The Steed series consists of somewhat excessively drained soils that have a very gravelly loamy sand subsoil. These soils formed in mixed alluvium derived from limestone, sandstone, and quartzite rocks. They are on alluvial fans at elevations of 4,550 to 5,700 feet. Slopes range from 0 to 10 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, big sagebrush, willow, and cottonwood. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 120 to 160 days. Steed soils are associated with Sterling, Ricks, and Winn soils.

In a representative profile, the surface layer is dark grayish-brown, mildly alkaline gravelly loam and very gravelly sandy loam about 17 inches thick. The substratum is grayish-brown, mildly alkaline very gravelly loamy sand that extends to a depth of 60 inches or more.

Steed soils are used mainly for irrigated and dryfarmed crops. Small areas are in native vegetation and are used as range.

Steed gravelly loam, 0 to 3 percent slopes (SvA).—This soil is mostly on alluvial fans and flood plains along the east side of Cache Valley.

Representative profile in a cultivated area, 1½ miles north of Richmond, 200 feet south and 200 feet east of the northwest corner of the southwest quarter of sec. 23, T. 14 N., R. 1 E.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak to moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; 15 percent gravel; mildly alkaline; moderately calcareous; clear, smooth boundary.

A11—5 to 11 inches, dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure mixed with weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few fine pores; 20 percent gravel; mildly alkaline; moderately calcareous; clear, smooth boundary.

A12—11 to 17 inches, dark grayish-brown (10YR 4/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common medium roots; 65 percent gravel and cobblestones; mildly alkaline; moderately calcareous; clear, wavy boundary.

C—17 to 60 inches, grayish-brown (10YR 5/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) when moist; massive; loose, nonsticky and nonplastic; few fine roots; 80 percent gravel and cobblestones; mildly alkaline; moderately calcareous.

The A1 horizon commonly is 20 to 50 percent gravel, but in places the upper 6 to 8 inches of this horizon is slightly less than 20 percent gravel. The C horizon is more than 50 percent gravel and contains a small amount of cobblestones. In places along the Blacksmith Fork River bottom, the water table is below a depth of 45 inches. The A1 horizon ranges from dark grayish brown to grayish brown. Texture is gravelly loam to cobbly loam in the upper part of the horizon and is very gravelly sandy loam or very gravelly light loam in the lower part. Thickness ranges from 7 to 18 inches. The C horizon ranges from grayish brown to light grayish brown or pale brown. Texture is very gravelly or very cobbly loamy sand to very gravelly sandy loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. The calcium carbonate equivalent ranges from 5 to 40 percent. Common, fine and medium, faint to distinct mottles are present in places.

This soil is fairly easy to till, but gravel causes excessive wear on tillage implements. Permeability is moderately rapid. Runoff is slow, and the hazard of erosion is slight. This soil holds 3 to 3¾ inches of available water to a depth of 5 feet. Only a few roots penetrate into the very gravelly material.

Included in mapping were small areas of Stony alluvial land and small areas of Steed gravelly loam, 3 to 6 percent slopes.

This soil is used mostly for irrigated crops of small grain and alfalfa. Small areas are used for apple and pear orchards. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Steed gravelly loam, 3 to 6 percent slopes (SvB).—This soil is on alluvial fans along the east side of Cache Valley. Except for slope, it is similar to Steed gravelly loam, 0 to 3 percent slopes. The surface layer is 7 to 14 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of soils that have slopes of 6 to 10 percent.

This soil is used mostly for irrigated crops of alfalfa and small grain. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Steed gravelly loam, 6 to 10 percent slopes (SvC).—This soil is on alluvial fans at the mouth of small canyons, mainly along the east side of Cache Valley. It is similar to Steed gravelly loam, 0 to 3 percent slopes, except that it is more sloping and its surface layer is 7 to 9 inches thick. Runoff is medium, and the hazard of erosion is moderate.

This soil is used mostly for dryfarmed crops of small grain and alfalfa. Some areas are idle, but where irrigation water is available, some are used for orchards. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Sterling Series

The Sterling series consists of somewhat excessively drained soils that have a very gravelly sandy loam subsoil. These soils formed in mixed alluvium and lake sediment derived from limestone, quartzite, and sandstone. They are on medium or high lake terraces, terrace escarpments, and foothills at elevations of 4,600 to 5,500 feet. Slopes range from 6 to 50 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, cheatgrass, and big sagebrush. The average annual precipitation ranges from 15 to 17 inches, the mean annual temperature is 46° to 48° F., and the frost-free season is 130 to 160 days. Sterling soils are associated with Ricks, Timpanogos, Parleys, and Steed soils.

In a representative profile, the surface layer is dark grayish-brown, mildly alkaline gravelly loam about 16 inches thick. The substratum is pale-brown, strongly alkaline very gravelly sandy loam and brown, moderately alkaline very gravelly loamy sand that extends to a depth of 60 inches or more.

Sterling soils are used mostly for range. Some areas are used for dryfarmed crops.

Sterling gravelly loam, 10 to 20 percent slopes (SwD).—This soil is in long, narrow strips on lake terrace escarpments along the east side of Cache Valley. It is cut by a few small gullies.

Representative profile in an area of native vegetation, about ½ mile northeast of Millville, about 500 feet west and 825 feet north of the southeast corner or sec. 15, T. 11 N., R. 1 E.:

A11—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; common fine pores; 30 percent gravel; moderately calcareous; mildly alkaline; clear, smooth boundary.

A12—9 to 16 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common fine pores; 50 percent gravel; strongly calcareous; moderately alkaline; abrupt, smooth boundary.

C1ca—16 to 27 inches, pale-brown (10YR 6/3) very gravelly sandy loam, grayish brown (10YR 5/2) when moist; massive; soft, nonsticky and nonplastic; few fine roots; 80 percent gravel; strongly calcareous; strongly alkaline.

C2—27 to 60 inches, brown (10YR 5/3) very gravelly loamy sand, brown to dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few fine roots; 80 percent gravel; strongly calcareous; moderately alkaline.

The A1 horizon ranges from grayish brown or dark grayish brown to brown. Texture ranges from gravelly loam to gravelly heavy sandy loam that is 20 to 50 percent gravel and, in places, some cobblestones. The calcium carbonate equivalent ranges from 5 to 15 percent in the All horizon and from 15 to 40 percent in the A12 horizon. Thickness ranges from 10 to 18 inches. The Cca and C horizons range from pale brown or brown to grayish brown or light gray in a hue of 10YR or 2.5Y. They are 50 to 80 percent gravel and cobblestones, and the horizons are strongly calcareous or very strongly calcareous. The calcium carbonate equivalent ranges from 15 to 60 percent. In places the gravel is weakly cemented by carbonates.

Permeability is moderately rapid. Runoff is medium, and the hazard of erosion is moderate. This soil holds 3 to 3¾ inches of available water to a depth of 5 feet. Only a few roots extend into the very gravelly loamy sand.

Included in mapping were small areas of Timpanogos silt loam, 10 to 20 percent slopes, eroded, and small areas of soils that have slopes of 20 to 30 percent.

This Sterling soil is used mostly for range. Some areas are used for dryfarmed crops of wheat and alfalfa. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Sterling gravelly loam, 6 to 10 percent slopes (SwC).—This soil is on lake terraces, dominantly along the east side of Cache Valley between Logan and Paradise. Except for slope, it is similar to Sterling gravelly loam, 10 to 20 percent slopes. The surface layer is 14 to 20 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Timpanogos silt loam, 6 to 10 percent slopes, and areas of Sterling gravelly loam, 20 to 30 percent slopes.

This soil is used mostly for dryfarmed crops of small grain. Some small areas are irrigated by sprinklers. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Sterling gravelly loam, 20 to 50 percent slopes, eroded (SwF2).—This soil is on long, narrow terrace escarpments, mainly along the east side of Cache Valley but also on the west side of the valley north of Clarkston. It is similar to Sterling gravelly loam, 10 to 20 percent slopes, but it is steeper and moderately eroded and its surface layer is 10 to 15 inches thick. In places cobblestones are on the surface and scattered throughout the profile. Runoff is rapid, and the hazard of erosion is high.

Included in mapping were small areas of Hillfield silt loam, 20 to 30 percent slopes, eroded, and areas of Sterling gravelly loam that has slopes of slightly more than 30 percent.

This soil is used mostly for range. Some areas have been cultivated in the past but are now idle. (Capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Stony Alluvial Land

Stony alluvial land (Sy) is a miscellaneous land type that consists of stony and cobbly material deposited on alluvial fans by flash floods during intensive summer thunderstorms. This land type is adjacent to very steep mountain slopes. Some areas support sparse stands of forage, but grazing is difficult because of the rough stones and cobblestones. These areas are not suited to most farm uses and are used mainly for limited grazing and wildlife habitat. (Capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Timpanogos Series

The Timpanogos series consists of well drained and moderately well drained soils that formed in mixed lake sediment derived from limestone, sandstone, and quartzite rocks. These soils are on medium and high lake terraces at elevations of 4,450 to 5,100 feet. Slopes range from 0 to 20 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, cheatgrass, gumweed, balsamroot, and big sagebrush. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 140 to 160 days. Timpanogos soils are associated with Parleys, Ricks, Hillfield, and McMurdie soils.

In a representative profile, the surface layer is grayish-brown, mildly alkaline and moderately alkaline silt loam and loam about 9 inches thick. The subsoil is brown to dark-brown, mildly alkaline loam about 9 inches thick. The substratum is pale-brown, moderately alkaline and strongly alkaline loam and very fine sandy loam to a depth of 60 inches or more.

Timpanogos soils are used mostly for irrigated crops, but some areas are used for dryfarming, range, or community developments.

Timpanogos silt loam, 0 to 3 percent slopes (TmA).—This gently undulating soil is on medium and high lake terraces along the east side of Cache Valley.

Representative profile in a cultivated area, about 2,100 feet north and 1,200 feet east of the northeast corner of River Heights Cemetery, sec. 35, T. 12 N., R. 1 E.:

Ap1—0 to 4 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure that parts to moderate, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; noncalcareous; moderately alkaline; clear, smooth boundary.

Ap2—4 to 9 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; noncalcareous; mildly alkaline; clear, wavy boundary.

B21t—9 to 13 inches, brown (10YR 5/3) loam, brown to dark brown (7.5YR 4/3) when moist; moderate, medium and fine, subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many fine pores; common thin clay films; noncalcareous; mildly alkaline; gradual, wavy boundary.

B22tca—13 to 18 inches, brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) when moist; moderate, medium and fine, subangular blocky structure; hard, friable, sticky and plastic; common fine roots; few thin clay films; strongly calcareous; mildly alkaline; clear, smooth boundary.

C1ca—18 to 29 inches, pale-brown (10YR 6/3) loam, brown to dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; very hard, friable, slightly sticky and plastic; few fine roots; common fine pores; very strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—29 to 42 inches, pale-brown (10YR 6/3) loam, brown to dark brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; very strongly calcareous; moderately alkaline; clear, wavy boundary.

C3—42 to 60 inches, pale-brown (10YR 6/3) very fine sandy loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine pores; strongly calcareous; strongly alkaline.

The A horizon ranges from 8 to 12 inches in thickness. In places the texture ranges from silt loam to loam or very fine sandy loam. In places the horizon contains a small amount of gravel. The color ranges from grayish brown to dark grayish brown or brown in a hue of 10YR or 7.5YR. Reaction ranges from moderately alkaline to neutral, and the horizon generally is noncalcareous. In some areas, however, in the vicinity of North Logan and Providence where strongly calcareous irrigation water is used, the horizon is slightly calcareous. The B2t horizon ranges from brown to light brown or dark brown in a hue of 10YR or 7.5YR. Texture is loam or silt loam to heavy loam. Thickness ranges from 8 to 14 inches. The Cca and C horizons range from pale brown to light brownish gray or light brown in a hue of 10YR or 7.5YR. The lower part of the C horizon ranges from silt loam to loamy fine sand. The calcium carbonate equivalent ranges from 25 to 45 percent. In places the water table is at depths between 40 and 60 inches.

The soil is easy to till. It is well drained and moderately permeable. Runoff is slow, and the hazard of erosion is slight. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet or more.

Included in mapping were small areas of Parleys silt loam, 0 to 3 percent slopes, and small areas of Ricks gravelly loam, 0 to 3 percent slopes.

This Timpanogos soil is used mostly for irrigated crops of alfalfa, small grain, beans, peas, sugar beets, corn for silage, and pasture. Some areas are used for community developments. (Capability unit IIc–2, irrigated, IIIe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Timpanogos silt loam, 3 to 6 percent slopes (TmB).—This soil is on medium and high lake terraces, dominantly along the east side of Cache Valley. It is similar to Timpanogos silt loam, 0 to 3 percent slopes, except that it is more sloping and its surface layer is 7 to 10 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Ricks gravelly loam, 3 to 6 percent slopes, and a few small areas of Parleys silt loam, 3 to 6 percent slopes.

This Timpanogos soil is mostly irrigated. The principal crops are alfalfa, sugar beets, and small grain. A few acres are used for apple orchards, and some areas are used for community developments. (Capability unit IIe–2, irrigated, IIIe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Timpanogos silt loam, 6 to 10 percent slopes (TmC).—This soil is on high lake terraces along the east side of Cache Valley. Except for slope, it is similar to Timpanogos silt loam, 0 to 3 percent slopes. The surface layer generally is 7 to 9 inches thick, but in places the subsoil has been exposed by tillage. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Hillfield silt loam with strongly calcareous surface and subsoil.

About half of the cultivated acreage is in irrigated crops of alfalfa and small grain and in apple orchards. The rest is used for dryfarmed crops of alfalfa and wheat. Some areas are used for community developments. (Capability unit IIIe–2, irrigated; IIIe–UE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Timpanogos silt loam, 10 to 20 percent slopes, eroded (TmD2).—This soil is on long, narrow breaks that separate other Timpanogos soils of lesser slopes. It is similar to Timpanogos silt loam, 0 to 3 percent slopes, except that it is more sloping and is moderately eroded. The surface layer generally is 4 to 9 inches thick, but in cultivated areas the subsoil has been exposed in places by tillage, and the slopes are broken by a few gullies. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Hillfield silt loam. Also included were small areas of a soil that has slopes of slightly more than 20 percent and areas of Parleys silt loam, 10 to 20 percent slopes.

About 50 percent of the acreage is used for dryfarmed crops of alfalfa and small grain. The rest consists mainly of very small areas that are idle or are in native vegetation and are used for range. (Capability unit IVe–2, irrigated, IVe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Timpanogos silt loam, deep water table, 0 to 3 percent slopes (TnA).—This soil is on broad, medium lake terraces, mainly in the north-central part of Cache Valley. It is similar to Timpanogos silt loam, 0 to 3 percent slopes, except that it is moderately well drained, has a fluctuating water table, and contains distinct, yellowish-red mottles at a depth of 36 to 54 inches. The surface layer is 10 to 13 inches thick. The larger areas are farther out in the valley than is typical for well-drained Timpanogos soils. Frosts in spring, caused by cold air drainage into the valley, are more likely to damage such crops as peas, corn, and sugar beets on this soil than on other Timpanogos soils.

Included in mapping were small areas of Kidman fine sandy loam, deep water table, 0 to 3 percent slopes, and small areas of soils that are slightly affected by alkali.

This Timpanogos soil is used for irrigated crops of alfalfa, sugar beets, small grain, peas, corn for silage, and for pasture. (Capability unit IIc-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Trenton Series

The Trenton series consists of somewhat poorly drained and moderately well drained soils that have a silty clay subsoil and are affected by salt and alkali. These soils formed in mixed lake sediment derived from limestone, sandstone, and quartzite. They are on lake terraces and valley plains at elevations of 4,400 to 4,700 feet. Slopes range from 0 to 20 percent. The vegetation is saltgrass, greasewood, alkali sacaton, Great Basin wildrye, western wheatgrass, and big sagebrush. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 150 days. Trenton soils are associated with Jordan, Lasil, Cache, Payson, Lewiston, and Airport soils.

In a representative profile (fig. 13), the surface layer is grayish-brown, mildly alkaline silty clay loam about 8 inches thick. The subsoil is grayish-brown, mildly alkaline and moderately alkaline silty clay about 26 inches thick. The substratum is pink, moderately alkaline and strongly alkaline, strongly calcareous silty clay to a depth of 60 inches or more.

Trenton soils are used mostly for dryfarming. Some areas are irrigated, and some are in native vegetation and are used for range.

Trenton silty clay loam, 0 to 2 percent slopes (TrA).—This soil is in the north-central part of Cache Valley on low lake terraces that are broken in places by deep gullies, which serve as drainageways.

Representative profile in a cultivated area, about 2 miles west of Richmond, 600 feet west and 200 feet north of the southeast corner of the northeast quarter of sec. 29, T. 14 N., R. 1 E.:

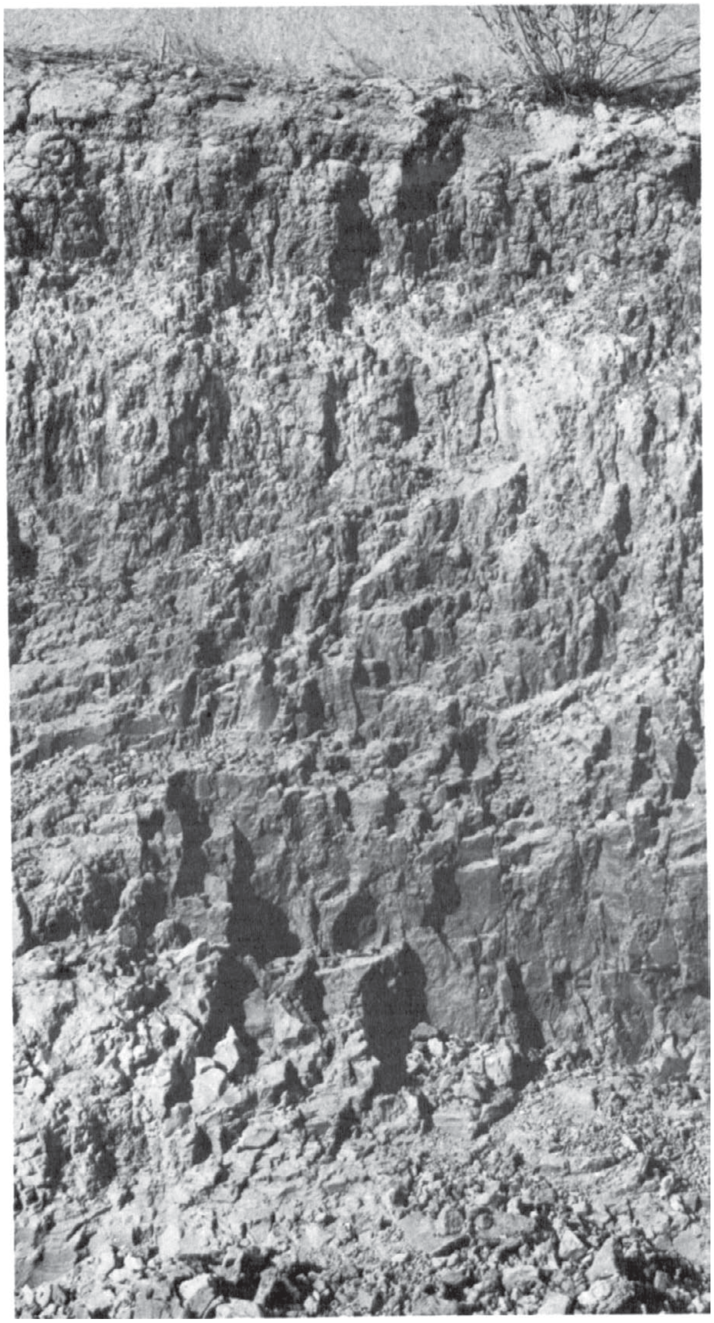

Figure 13.—Profile of Trenton silty clay loam, 0 to 2 percent slopes.

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; hard, friable, sticky and plastic; common fine and medium roots; noncalcareous; mildly alkaline; abrupt, smooth boundary.

B21t—8 to 15 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots; few fine pores; common thin clay films; slightly calcareous; mildly alkaline; clear, wavy boundary.

B22tca—15 to 26 inches, pale-brown (10YR 6/3) silty clay, brown (10YR 5/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores; common thin clay films; strongly calcareous; moderately alkaline; clear, wavy boundary.

B3ca—26 to 34 inches, pink (7.5YR 7/4) silty clay, light brown (7.5YR 6/4) when moist; moderate, coarse, prismatic structure that parts to moderate, medium, subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; few fine pores; few thin clay films; very strongly calcareous, lime is soft, laminar and veined; strongly alkaline; clear, wavy boundary.

C1ca—34 to 60 inches, pink (5YR 7/3) silty clay, reddish brown (5YR 5/3) when moist; common, fine, faint, yellowish-red (5YR 5/6) mottles; massive; extremely hard, extremely firm, very sticky and very plastic; few fine roots; strongly calcareous; moderately alkaline; gradual, smooth boundary.

C2—60 to 72 inches, pink (5YR 7/4) silty clay, reddish brown (5YR 5/3) when moist; few, fine, faint, yellowish-red (5YR 5/6) mottles; weak, coarse, prismatic structure that parts to moderate, coarse, blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; strongly calcareous; strongly alkaline.

The A horizon ranges from 7 to 10 inches in thickness. Texture is mainly silty clay loam but ranges from heavy silt loam to light silty clay. In places the horizon is slightly calcareous or moderately calcareous. Distinct, yellowish-brown to yellowish-red mottles are at a depth below 32 to 40 inches. The A1 horizon ranges from grayish brown to brown in a hue of 10YR or 7.5YR. Reaction is mildly alkaline to moderately alkaline. The B2t horizon ranges from dark grayish brown to brown in the upper part to pale brown or light brown in the lower part in a hue of 10YR or 7.5YR. Texture is dominantly silty clay but in places is clay. Reaction ranges from mildly alkaline to very strongly alkaline. The exchangeable sodium percentage ranges from 14 to 35. The B2tca and B3ca horizons are strongly calcareous or very strongly calcareous. The Cca and C horizons range from pink to very pale brown or pinkish gray in a hue of 10YR, 7.5YR, or 5YR. Texture ranges from silty clay to heavy silty clay loam, and thin strata of fine sand are present in places.

This soil is moderately difficult to till and compacts if cultivated when wet. Where it is associated with Lewiston soils, the upper 2 to 3 inches of the surface layer is fine sandy loam. This soil is moderately well drained and is slowly permeable. Runoff is slow, and the hazard of erosion is slight. This soil holds about 10 inches of water to a depth of 5 feet, but only 8 to 9 inches are available for plant use because of the salt and alkali in the lower part of the profile. The water table most commonly is below a depth of 40 inches. Most roots penetrate to a depth of about 2 feet and only a few penetrate to a depth of 3 to 4 feet.

Included in mapping were areas of Cache silty clay in low-lying areas and many areas of slickspots.

About 70 percent of the acreage is used for dryfarmed crops of alfalfa and small grain. Where irrigation water is available, alfalfa, small grain, sugar beets, corn for silage, and pasture plants are grown. (Capability unit IVw–28, irrigated, IIIs–U8, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Trenton silty clay loam, 2 to 4 percent slopes (TrB).—This soil is on low lake terraces in the north-central part of Cache Valley. It is associated with Trenton silty clay loam, 0 to 2 percent slopes, and, except for slope, is similar to that soil. Runoff is slow to medium, and the hazard of erosion is slight.

Included in mapping were small areas of Trenton soils that have a deep water table and a few small areas of a soil that has slopes of 4 to 8 percent.

This Trenton soil is used mainly for dryfarmed crops of small grain and alfalfa. Some areas are used for irrigated crops of alfalfa, small grain, corn for silage, and for pasture. (Capability unit IVw–28, irrigated, IIIs–U8, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Trenton silty clay loam, 4 to 8 percent slopes (TrC).—This soil is in small tracts at the head of gullies on low lake terraces in the north-central part of Cache Valley. It is similar to Trenton silty clay loam, 0 to 2 percent slopes, except that it is more sloping and its surface layer is 7 to 9 inches thick. In places tillage has exposed the subsoil. Runoff is medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for dryfarmed crops of alfalfa and small grain. Small areas are used for irrigated crops of alfalfa and small grain and for pasture and range. (Capability unit IVw–28, irrigated, IIIs–U8, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Trenton silty clay loam, 8 to 20 percent slopes, eroded (TrD2).—This soil is generally in long, narrow tracts on the sides of gullies. It is similar to Trenton silty clay loam, 0 to 2 percent slopes, except that it is more strongly sloping and its surface layer generally is only 7 to 8 inches thick. This soil is moderately eroded. In places plowing has exposed the subsoil. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Included in mapping were small areas of soils that have slopes of 20 to 30 percent and small areas of somewhat poorly drained Trenton soils adjacent to intermittent streams.

This Trenton soil is used chiefly for dryfarmed crops of small grain and alfalfa. Small areas are used for range. (Capability unit IVe–U8, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes (TtA).—This soil is on low lake terraces, mainly in a large area southwest of Cornish and a smaller area south of Benson. It is similar to Trenton silty clay loam, 0 to 2 percent slopes, except that the water table is between depths of 20 and 40 inches and the soil is more strongly affected by salt and alkali throughout the profile. The surface layer ranges from 8 to 15 inches in thickness and is dark brown in color. This soil is very slowly permeable.

Included in mapping were small areas of Lewiston fine sandy loam and Cache silty clay.

This Trenton soil is somewhat poorly drained. In places where it has been drained, it is used for irrigated crops of alfalfa, barley, sugar beets, corn for silage, and for improved pasture. Most areas are in native saltgrass and are used for pasture. (Capability unit IVw–28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Wheelon Series

The Wheelon series consists of well-drained soils that formed in mixed lake sediment derived from tuff, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are on rolling terraces and foothills at elevations of 4,500 to 5,300 feet. Slopes range from 10 to 70 percent. The vegetation is bluebunch wheatgrass, Indian ricegrass, prairie junegrass, balsamroot, and big sagebrush. The average annual precipitation ranges from

14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 110 to 140 days. Wheelon soils are associated with Collinston, Mendon, Avon, Barfuss, Leatham, and LaPlatta soils.

In a representative profile, the soil is light brownish-gray to white, mildly alkaline to moderately alkaline, strongly calcareous silt loam that extends to a depth of 60 inches or more.

Wheelon soils are used for dryfarmed crops and for range.

Wheelon silt loam, 10 to 30 percent slopes (WhE).—This soil is on high lake terrace escarpments, chiefly along the west side of Cache Valley. Most slopes are short, and the soil is moderately to severely eroded.

Representative profile in a cultivated area, about 1 mile north and 2 miles west of Newton, 200 feet north and 3,000 feet west of the southeast corner of sec. 11, T. 13 N., R. 2 W.:

Ap—0 to 6 inches, light brownish-gray (2.5Y 6/2) silt loam, grayish brown to light olive brown (2.5Y 5/3) when moist; weak, medium, subangular blocky structure and weak, fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; many fine roots; few fine pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

AC—6 to 12 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; many fine roots; few fine pores; strongly calcareous; mildly alkaline; gradual, wavy boundary.

C1ca—12 to 23 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, friable, nonsticky and nonplastic; few fine and large roots; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—23 to 43 inches, white (2.5Y 8/2) silt loam, light gray (2.5Y 7/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; few fine and medium pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C3—43 to 66 inches, white (5Y 8/2) silt loam, light olive gray (5Y 6/2) when moist; common, medium, distinct, brownish-yellow (10YR 6/6) mottles; massive; slightly hard, friable, nonsticky and nonplastic; strongly calcareous; moderately alkaline.

The A horizon ranges from light brownish gray to grayish brown or pale brown in a hue of 2.5Y or 10YR. Texture ranges from silt loam to light silty clay loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately to strongly calcareous. Thickness ranges from 6 to 16 inches. The Cca and C horizons range from white to light gray or pale yellow. Texture ranges from silt loam to very fine sandy loam or light silty clay loam. Reaction is moderately alkaline to strongly alkaline, and the horizon is strongly calcareous. Some areas of this soil have partially consolidated tuffaceous limestone and sandstone below a depth of 24 inches. In places gravel or cobblestones are scattered on as much as 5 percent of the surface and some loose gravel or cobblestones are at a depth below 40 inches.

Permeability is moderate to slow. Runoff is rapid, and the hazard of erosion is high. This soil holds 5 to 7.5 inches of available water to a depth of 5 feet. Most roots penetrate to a depth of 20 to 25 inches.

Included in mapping were small areas of Collinston loam, 10 to 30 percent slopes.

This Wheelon soil is used mainly for dryfarmed crops of alfalfa and winter wheat. Small areas are idle or are used to a limited extent for range. (Capability unit VIe–U1, nonirrigated; Upland Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Wheelon silt loam, 30 to 50 percent slopes, eroded (WhF2).—This soil is on high lake terrace escarpments and foothills surrounding Cache Valley. Runoff is very rapid, and the hazard of erosion is very high.

Included in this mapping unit were small areas of Collinston loam, 10 to 30 percent slopes.

This Wheelon soil is used as range that is grazed to a limited extent after crops on adjacent soils have been harvested. (Capability unit VIIe–U1, nonirrigated; Upland Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Wheelon-Collinston complex, 10 to 30 percent slopes, eroded (WlE2).—This complex is on medium and high lake terraces surrounding Cache Valley. About 60 percent of the complex is Wheelon silt loam, 10 to 30 percent slopes, eroded, and 40 percent is Collinston loam, 10 to 30 percent slopes, eroded. The hazard of erosion is high, and these soils are moderately eroded.

The steep Wheelon soil generally is on south- and west-facing, convex knolls and ridges.

The moderately sloping and strongly sloping Collinston soil is in north- and east-facing areas between ridges and swales. Except for slope, it is similar to Collinston loam, 6 to 10 percent slopes, described under the Collinston series.

Included in mapping were small areas of gently sloping Mendon silt loam that have north-facing slopes, and small areas that are in swales.

Soils of this mapping unit are used for dryland crops of winter wheat, alfalfa, and alfalfa-grass mixtures. The soils are well suited to a permanent cover of grasses. (Both soils are in capability unit VIe–U1, nonirrigated. Wheelon soil is in Upland Shallow Loam range site; Collinston soil is in Upland Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 2)

Winn Series

The Winn series consists of somewhat poorly drained soils that formed in mixed alluvium derived from limestone, sandstone, and quartzite. These soils are on flood plains of the Little Bear and Cub Rivers and on low lake terraces at elevations of 4,450 to 4,900 feet. Slopes range from 0 to 3 percent. The vegetation is Kentucky bluegrass, saltgrass, gumweed, willows, wild rose, sedges, and wiregrass. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 150 days. Winn soils are associated with Kirkham, Woods Cross, and Provo soils.

In a representative profile, the soil is dark-gray to grayish-brown, mildly alkaline loam and silt loam that extends to a depth of 60 inches or more.

Winn soils are used mostly for irrigated crops. Some areas are used for range.

Winn silt loam (Wn).—This soil is on flood plains and low terraces that are dissected by old river channels. It is mostly in areas adjacent to the Little Bear and Cub River drainages. Slopes range from 0 to 3 percent.

Representative profile in a cultivated area, about 2 miles northeast of Wellsville, 1,300 feet north and 800 feet west of the southeast corner of sec. 26, T. 11 N., R. 1 W.:

A11—0 to 6 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

A12—6 to 13 inches, dark-gray (10YR 4/1) loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; many fine and medium roots; common medium pores; moderately calcareous; mildly alkaline; clear, wavy boundary.

AC—13 to 18 inches, dark-gray (2.5Y 4/1) loam, very dark gray (2.5Y 3/1) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common large pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C1—18 to 40 inches, grayish-brown (10YR 5/2) loam, very dark gray (2.5Y 3/1) when moist; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and large roots; common large pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C2—40 to 60 inches, dark-gray (2.5Y 4/1) silt loam, very dark gray (2.5Y 3/1) when moist; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; hard, friable, slightly sticky and plastic; many fine and medium roots; common fine pores; moderately calcareous; mildly alkaline.

The A1 horizon ranges from dark gray to very dark gray or to dark grayish brown. Texture is silt loam to loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. Thickness ranges from 12 to 20 inches. The C horizon ranges from grayish brown to dark gray, gray, or light grayish brown. Common to many, fine, distinct, brown to yellowish-brown (10YR 5/8 and 7.5YR 5/4) mottles are below a depth of 16 inches. The horizon ranges from loam to silt loam or very fine sandy loam and is somewhat stratified.

This soil is easy to till. Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. In years when runoff is high in spring, some areas are inundated for a short period. If this soil is drained, it holds 8 to 10 inches of available water to a depth of 5 feet. The depth to the water table fluctuates with the water level in the rivers, but during the growing season the water table is mainly below a depth of 30 to 50 inches. Roots penetrate to the water table easily.

Included in mapping were small areas of Provo gravelly loam in poorly drained, isolated oxbows and in channeled areas. Also included were small areas of Kirkham silt loam along the Cub River bottoms.

This Winn soil is used mostly for irrigated crops of alfalfa, small grains, sugar beets, corn for silage, and pasture. (Capability unit IIIw-2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Winn-Provo complex (Wp).—This complex is mainly on the Logan River, Blacksmith Fork, and Little Bear River flood plains. About 60 percent of the complex is Winn silt loam, moderately deep over gravel, and 40 percent is Provo loam. In years when runoff is high in spring, these soils are subject to overflow for a short period.

The Winn soil is similar to Winn silt loam, except that it has gravelly sandy loam material below a depth of 36 inches.

In places, generally on the flood plain of the Blacksmith Fork River, the Provo soil is weakly cemented by lime in the lower part of its substratum.

Included in mapping were small areas of gravelly and cobbly riverwash material and small areas of deep, poorly drained, loamy soils.

Soils of this mapping unit are used for irrigated crops of alfalfa and small grain and for native pasture. (Capability unit IIIw-2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Woods Cross Series

The Woods Cross series consists of poorly drained soils that have a heavy clay loam subsoil. These soils formed in noncalcareous alluvium derived from sandstone, quartzite, and shale. They are on flood plains and low fans at elevations of 4,600 to 5,000 feet. Slopes are 0 to 3 percent. The vegetation is wiregrass, sedges, foxtail, and clover. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Woods Cross soils are associated with Winn and Kirkham soils.

In a representative profile, the soil is very dark gray, neutral or mildly alkaline heavy silty clay loam, clay loam, and heavy clay loam to a depth of 36 inches. Below this is gray, mildly alkaline loam to a depth of 60 inches or more.

Woods Cross soils are used mostly for irrigated alfalfa and small grain and for meadow hay and native grass pasture.

Woods Cross silty clay loam (Wr).—This soil is on flood plains and low-lying alluvial fans, mainly along the Little Bear River south of the community of Avon. Slopes range from 0 to 3 percent.

Representative profile in a wet meadow pasture, about three-fourths mile south of Avon, 900 feet south and 300 feet west of the northeast corner of sec. 15, T. 9 N., R. 1 E.:

O1—2 inches to 0, matted roots and plant residue.

A11—0 to 8 inches, very dark gray (2.5Y 3/1) heavy silty clay loam, black (10YR 2/1) when moist; weak, medium and fine, granular structure; very hard, very firm, slightly sticky and plastic; common fine and medium roots; neutral; clear, smooth boundary.

A12—8 to 16 inches, dark-gray (2.5Y 4/1) clay loam, very dark gray (2.5Y 3/1) when moist; weak, fine, subangular blocky structure; very hard, very firm, slightly sticky and plastic; common fine roots and few medium roots; mildly alkaline; clear, smooth boundary.

A13—16 to 26 inches, very dark gray (2.5Y 3/1) heavy clay loam, black (2.5Y 2/1) when moist; massive; very hard, very firm, slightly sticky and plastic; common fine and medium roots; neutral; gradual, smooth boundary.

AC—26 to 36 inches, dark-gray (2.5Y 4/1) heavy clay loam, black (2.5Y 2/1) when moist; common distinct mottles; massive; extremely hard, very firm, slightly sticky and plastic; many fine roots and few medium roots; noncalcareous; mildly alkaline; clear, smooth boundary.

C1—36 to 60 inches, gray (2.5Y 5/1) loam, very dark gray (2.5Y 3/1) when moist; common distinct mottles; massive; extremely hard, firm, sticky and plastic; few medium roots; noncalcareous; mildly alkaline.

The A1 horizon has a hue of 10YR or 2.5Y. Distinct mottles are present in or immediately below this horizon. Texture ranges from heavy silty clay loam or heavy clay loam to heavy silt loam. The horizon is dominantly noncalcareous, but in places it is slightly calcareous because of overwash or the calcareous water used for irrigation. Thickness ranges from 24 to 40 inches. The C horizon ranges from gray to very dark gray, dark olive gray, or olive gray in hues of 2.5Y and 5Y. This horizon ranges from silty clay loam to loam and generally is stratified. In places gravel and sand are at a depth below 40 inches.

Permeability is slow. Runoff is slow or very slow, and the hazard of erosion is none to slight. Some areas are inundated for short periods in years of high runoff in spring. If this soil is drained, it holds 8 to 10 inches of available water to a depth of 5 feet. The depth to the water table ranges from 10 to 30 inches in undrained areas. Most roots penetrate to the water table.

About 60 percent of the acreage is in native vegetation and is used for meadow pasture and hay. The rest of the acreage is partially drained and is used for irrigated crops and small grain, alfalfa, and pasture. (Capability unit IIIw-25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Yeates Hollow Series

The Yeates Hollow series consists of well-drained soils that have very cobbly and stony clay subsoil. Fractured bedrock is at a depth of 40 to 60 inches. These soils formed in residuum, colluvium, and alluvium derived from quartzite and sandstone. They are on mountain slopes and fans at elevations of 5,500 to 8,000 feet. Slopes range from 3 to 70 percent. The vegetation is bluebunch wheatgrass, native bluegrass, slender wheatgrass, big sagebrush, bitterbrush, snowberry, and mulesear dock. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature is 38° to 43° F., and the frost-free season is 80 to 110 days. Yeates Hollow soils are associated with Goring, Obray, Sheep Creek, and Datwyler soils.

In a representative profile, the surface layer is brown, neutral extremely stony silt loam about 11 inches thick. The upper part of the subsoil is brown, neutral very cobbly clay loam and brown, slightly acid very cobbly clay. The lower part of the subsoil is reddish-brown, medium acid very cobbly clay loam. Bedrock is at a depth of about 46 inches.

Yeates Hollow soils are used for range, watershed, and wildlife habitat.

Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes (YHG).—This mapping unit is mainly at the head of Little Bear River and in Blacksmith Fork Canyon. It is mainly on southern, eastern, and western exposures, but to a small extent it is on northern exposures in the mountains and on the southern exposures of steep canyons. Slopes are dominantly 40 to 65 percent. About 30 percent of the mapped areas is quartzite rock outcrop and talus. The quartzite outcrop is scattered and is mainly ledges and convex ridgetops.

Representative profile of Yeates Hollow extremely stony silt loam in an area of Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes, 1.2 miles east of the mouth of North Cottonwood Canyon in Blacksmith Fork Canyon, 600 feet south and 800 feet east of the northwest corner of sec. 16, T. 10 N., R. 3 E.:

A1—0 to 11 inches, brown (7.5YR 5/3) extremely stony silt loam, dark yellowish brown (10YR 3/4) when moist; moderate, coarse, granular structure that parts to fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few coarse roots; many, very fine, tubular and interstitial pores; 30 percent angular gravel and cobblestones and 3 percent stone; neutral; clear, wavy boundary.

B1—11 to 18 inches, brown (7.5YR 5/4) very cobbly clay loam, dark brown (7.5YR 3/4) when moist; moderate, coarse, subangular blocky structure that parts to fine subangular blocky structure; hard, very firm, sticky and plastic; common fine roots; many, very fine, tubular and interstitial pores; thin continuous clay films; 50 percent angular gravel and cobblestones; neutral; clear, wavy boundary.

B21t—18 to 33 inches, brown (7.5YR 5/4) very cobbly light clay, dark brown (7.5YR 4/4) when moist; strong, medium, subangular blocky structure; hard, extremely firm, very sticky and very plastic; few fine roots; many, very fine, tubular and interstitial pores; moderately thick continuous clay films; 65 percent angular gravel and cobblestones; slightly acid; clear, wavy boundary.

B22t—33 to 46 inches, reddish-brown (5YR 4/4) very cobbly clay loam, reddish brown (5YR 4/4) when moist; strong, medium, subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; thin continuous clay films; 65 percent angular cobblestones; medium acid.

R—46 inches, rock fragments or fractured bedrock (more than 90 percent rock).

The combined thickness of the A1, B1, and B2t horizons ranges from 40 to 60 inches or more over fractured bedrock. Coarse fragments are mixed, cobblestone-, gravel-, and stone-size sandstone and quartzite. Their content ranges from 15 to 60 percent cobblestones and gravel, and as much as 10 percent stones, in the A horizon; it ranges from 50 to 85 percent in the B horizon. The A1 horizon ranges from brown or dark grayish brown to dark brown in hues of 10YR and 7.5YR. Reaction is medium acid to neutral. Thickness ranges from 8 to 13 inches. The B1 horizon ranges from brown to reddish brown or dark brown in hues of 10YR, 7.5YR, and 5YR. Texture ranges from very cobbly clay loam or very cobbly silty clay loam to very cobbly loam. Reaction is slightly acid to neutral. Thickness ranges from 4 to 13 inches. The B2t horizon ranges from brown or reddish brown to light brown, light reddish brown, or strong brown in a hue of 7.5YR, 5YR, or 10YR. Texture ranges from very cobbly heavy sandy clay loam to very cobbly clay. Reaction ranges from strongly acid to neutral.

Permeability is slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 4 to 6 inches of available water to a depth of 5 feet. Roots penetrate to bedrock. The depth to bedrock ranges from 40 to more than 60 inches.

Included in mapping were areas of Foxol rocky loam, 30 to 60 percent slopes, which make up 5 percent of the total acreage. Also included were small areas of a soil that has slopes of 6 to 30 percent.

This Yeates Hollow soil is used for range, watershed, and wildlife habitat. (Capability unit VIIs-MX4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Yeates Hollow extremely rocky silt loam, 6 to 30 percent slopes (YHE).—This soil is on southern, western, and eastern exposures in mountainous areas. Except for slope, it is similar to Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes. The surface layer is 10 to 14 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate. About 25 percent of the mapped areas is quartzite rock outcrop. The outcrop is in no definite pattern, but it is commonly on slightly convex ridges. Areas of outcrop are about 2 square yards to 3 to 4 acres in size.

Included in mapping were areas of Goring silt loam, 6 to 30 percent slopes; Foxol rocky loam; and Obray silty clay, 1 to 6 percent slopes. The Goring soil makes up 6 percent of the mapped areas, the Foxol soil 3 percent, and the Obray soil 1 percent.

This Yeates Hollow soil is used for range, wildlife habitat, and watershed. (Capability unit VIIs-MX4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Yeates Hollow extremely stony silty clay loam, 3 to 30 percent sopes, eroded (YLE2).—This soil is on fans and benches in the Ant Flat, Hardware Ranch, and Davenport Creek areas and west of the Little Bear River, south of Avon. It is similar to Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes, except that it is not so steep, it is moderately eroded, and rock outcrop makes up less than 2 percent of the mapped areas. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Bedrock is generally at a depth of more than 60 inches.

This soil is used for range, a source of water, and wildlife habitat. (Capability unit VIIs-MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Use and Management of the Soils for Crops[2]

Soils differ in their suitability for farming and in the management they require for production of crops and the control of erosion. The most precise statement about soils and predictions about their use and management can best be made according to the individual soils. Some broad generalizations, however, can be made about groups of soils, and certain principles of management apply to all soils under specified kind of land use. This section of the soil survey discusses (1) general management for crops on irrigated soils, (2) general management for crops on nonirrigated soils, (3) capability of soils, and (4) crop yields.

General Management for Crops on Irrigated Soils

In the survey area, some principles of management are common to a large number of soils that are irrigated. These common management practices are discussed in the following paragraphs.

Crop selection and rotation.—The principal crops grown are alfalfa, small grain, sugar beets, corn for silage, and improved pasture. Some other crops grown to a limited extent are peas, potatoes, sweet corn, green beans, sugar beets for seed, apples, pears, sour cherries, and peaches. The production of fruit and of other crops sensitive to frost is limited to areas that have good air drainage.

Alfalfa.—Alfalfa is the most important crop and is grown on irrigated soils. Generally, alfalfa is planted with a nurse crop of small grain in the spring. Occasionally, it is planted alone or seeded in grain stubble late in August or in September. Three cuttings of alfalfa are generally made in one season. Most of the alfalfa is cut and baled. The third or fourth crop of alfalfa is commonly grazed. Occasionally, alfalfa seed is harvested from the second crop on some soils.

On almost all of the soils, alfalfa responds to phosphate fertilizer. Phosphate fertilizer is generally applied to alfalfa during the second year after seeding.

Small grain.—Barley and wheat are the principal small grains, but some oats are grown. These crops can be grown on all of the irrigated soils. Small grain is generally planted between March 15 and April 30. Winter wheat is planted from August to October. Most of the straw is baled and removed, although a considerable amount of crop residue is generally turned under. The small grain crops are generally fertilized with nitrogen. This increases the yield on most soils.

Corn.—Corn is generally planted the first year after alfalfa is plowed out. Corn is a valuable feed for cattle and grows well on most of the irrigated soils. It is usually planted from May 1 to May 10 and is harvested late in August. Most of the corn is used for silage.

Where manure is available, it is generally applied before the corn or other row crop is planted. Where manure is not available, nitrogen fertilizer is generally applied to the soil before corn is planted.

Sugar beets.—Sugar beets are the most important cash crop in the survey area. Because of nematodes, this crop is generally grown only 1 year of the crop rotation cycle. The sugar beet crop is generally planted from March 15 to April 15 and harvested early in October. Crop yields on most soils are increased by applying both nitrogen and phosphate fertilizers.

Pastures.—Improved pasture plants are grown in rotation with other crops or planted for permanent pasture. They are a suitable crop on all of the irrigated soils. Some of the steep, gravelly, and cobbly or saline and alkali soils are best suited to permanent pastures. These improved pastures consist generally of grass-legume mixtures. The kind of grass and legume grown depends on the kind of soil. Alfalfa, ladino clover, and sweetclover are commonly used as legumes. Smooth brome, tall oatgrass, alta fescue, and reed canarygrass are common grasses. Pastures are generally fertilized with nitrogen and phosphate annually.

Cropping systems.—The cropping system is variable, and the crops that are grown are determined according to the kind of soil and the location of the farm enterprise. Soil-building crops such as alfalfa or other legumes and grasses should be included in all cropping systems. These crops help counteract the soil-depleting effects of row crops and small grain. Generally, alfalfa is grown for 3 to 6 years, corn or small grain for 1 year, sugar beets for 1 year, and small grain for 1 or 2 years. Alfalfa is reseeded with the last crop of small grain. Sugar beets or corn, or both, are commonly omitted from the crop rotation system.

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[2] DONALD A. DRAGE and R. DEANE HARRISON, work unit conservationists, Soil Conservation Service, assisted in the preparation of this section.

Organic matter and fertilizer.—Organic matter consists of plant and animal residue in various stages of decomposition. The organic-matter content of the soil can be maintained or increased by adding farm manure, by turning under crop residue and green manure, and by using a cropping system that includes legumes and grasses.

Farm manure is one of the most readily available sources of organic matter. It is also an excellent fertilizer. Cow manure generally contains about 10 pounds of nitrogen and 5 pounds of phosphate per ton. Ten tons of cow manure per acre provides a good supply of plant nutrients.

Organic matter (1) improves soil structure and workability, (2) improves the water-intake rate and water-holding capacity, (3) provides a reserve of plant nutrients, (4) increases the resistance of soils to erosion, and (5) increases biological activity by providing an energy source for micro-organisms. A good soil management plan includes the addition of organic matter to the soil.

Fertilizer is used to replace the plant nutrients removed from the soil by cropping, leaching, or erosion. Nitrogen and phosphorus are the most common nutrients needed to supplement the natural supply of plant nutrients in the soils of the survey area. Most crops require nitrogen fertilizer for high yields. Legumes, such as alfalfa and clover, generally do not need nitrogen fertilizer. If crops lack nitrogen, they grow more slowly and have a light-green color. The application of fertilizer to soils used for fruit trees should be governed by the age of the tree and its terminal growth. Sugar beets, potatoes, vegetables, and alfalfa and other legumes require large amounts of phosphorous fertilizer for high yields. Grass, small grain, and corn require less phosphorus than other crops. To produce high yields of crops, most soils need an application of phosphorous fertilizer at least once in each rotation. Soil tests for phosphorus should be used as a guide in applying phosphorous fertilizer. The commercial fertilizers most used in the survey area are ammonium sulfate or ammonium nitrate for nitrogen and treble superphosphate for phosphorus.

The potassium content of soils is generally adequate for the requirement of most crops. It is possible that some of the sandy soils, such as the Preston and Layton soils, may become deficient as the potassium is depleted by crops.

In places the soil is deficient in iron and other minor elements. These deficiencies can be corrected by proper amendments.

Irrigation.—Irrigation is a means of supplying water to the soil for use by crops. Proper use of irrigation water increases suitability of the soils for crops. Too much water leaches plant nutrients from the soil and may cause erosion or excessive wetness.

All farm irrigation systems should (1) deliver the quantity of water needed to permit efficient irrigation, (2) deliver water with a minimum loss of soil, water, time, and labor, (3) provide for accurate and efficient control of water flow and measurement, (4) provide adequate disposal of waste water or runoff, and (5) be maintained easily and practically.

Several methods of irrigation provide good control of the water. Before selecting the method of irrigation, consideration should be given to the slope of the soils, the kinds of soils and their ability to absorb and hold moisture, the depth to which crop roots penetrate and the amount of water the crops need, and the amount and quality of the water supply.

Border, furrow, corrugation, contour ditch, flooding, and sprinkler methods of irrigation are commonly used in the survey area. Border and furrow irrigation are best suited to soils that have slopes of less than 3 percent. Furrows are used primarily for row crops, and borders are used for close-growing perennial crops. Corrugations are used principally for noncultivated crops where slopes are less than 10 percent. Sprinkler irrigation can be used on all soils and for all crops, but it is especially well suited to steep soils, to gravelly or sandy soils, or to soils that have not been leveled, where other irrigation methods are not practical.

Land leveling.—Leveling helps provide for better control and uniform distribution of irrigation water. A well-leveled field is one that has a smooth, uniform grade in the direction of irrigation and has only minimum side slope.

Some factors to consider before leveling are the depth and kind of soil, grade, crops to be grown, amount of irrigation water needed, size of irrigation stream, method of irrigating, field boundaries, and type of farm machinery used.

Deep cuts should not be made in fields where the soils are shallow. Soils that have a water table may require additional drainage in cut areas. Soil compaction caused by leveling equipment can be corrected by ripping, subsoiling, or fall plowing.

Where deep cuts have been made, large applications of manure and commercial fertilizer may be needed to help restore fertility. Generally, leveling in fall is preferable to leveling in spring because preparation of a good seedbed is difficult immediately after the soils are leveled in spring. Small grain or other annual crops should be planted the first year after leveling to allow for settling and to permit additional smoothing before a permanent crop is seeded.

Drainage and reclamation.—Somewhat poorly drained and poorly drained soils require artificial drainage for maximum production of cultivated crops, and restricted drainage limits the kinds of crops that can be grown. Excess water in the soil restricts the development of roots and retards the movement of air and water.

The principal purpose of drainage is to remove excess water from the soil. When the excess water is removed, aeration increases, the soil warms up sooner in spring, organic matter decays faster, nitrification takes place more rapidly, and the depth of the rooting zone is increased.

In many irrigated areas the removal of salt from the soil may be of more significance than the removal of excess water. Where salinity limits use of a soil for crops, excess water for leaching is necessary and the need for adequate drainage is increased.

The areas to be drained must be carefully studied before installing a drainage system. This study should include (1) measurements of water table depth over the area at frequent intervals throughout the year; (2) determination of the rate of movement and direction of flow of ground water; (3) estimation of the amount of water to be removed and outlet possibilities; (4) preparation of a topographic map and evaluation of the geology and physiography of the area; (5) determination of the physical and chemical properties and the behavior of the soil, including texture, permeability, rate of infiltration, and the amounts of soluble salts, exchangeable sodium, lime, and gypsum; (6) determination of the kind of crops to be grown after the soil is drained; (7) the relative cost of the drainage system.

Drainage systems are costly and commonly are difficult to install. Therefore, the practicability of making this improvement depends on the benefits that can be expected. Open ditches are commonly used to remove excess surface water and ground water from areas where tile or other types of drainage systems are impractical or too costly. Most soils of the Collett, Greenson, Kirkham, Logan, Roshe Springs, and Winn series require only drainage for high production of cultivated crops. Soils of the Airport, Trenton, and Lewiston series, however, contain harmful concentrations of salts or alkali, and some contain both. These soils require leaching irrigations, and they are likely to require a soil amendment, such as gypsum, to make them better suited to crops.

Soils affected by salt and alkali are reclaimed by obtaining adequate drainage, leveling for a uniform distribution of irrigation water, and leaching the salt and alkali from the soil by applying large quantities of irrigation water. Leveling for border or basin irrigation makes possible the most uniform distribution of water. If leaching is to be effective in removing salt and alkali from the soil, at least 10 percent or more of the water applied should be carried away in the drains. Special cropping and additions of crop residue or manure may facilitate leaching where the soil is made more permeable by crop roots or the added residue. Barley, sweetclover, tall wheatgrass, alta fescue, and reed canarygrass are adapted to wet conditions and are slightly to moderately tolerant of salt. These crops are useful in aiding the leaching process. The application of proper amounts of gypsum or sulfur generally speeds up the reclamation process.

Alkali soils have a high percentage of exchangeable sodium—more than 15 percent. This is sufficient sodium to affect the growth of most cultivated crops. The pH generally ranges from 8.5 to 10.0 unless the soils also have a high content of salt, in which case the pH is seldom higher than 8.5. Sodium has a markedly detrimental influence on the physical and chemical properties of the soil. As the proportion of exchangeable sodium increases, the soil tends to become more dispersed. Dispersed and dissolved organic matter in the soil solution may be deposited on the surface by evaporation and cause a darkening of the surface. The deposit is referred to as black alkali.

In saline soils the conductivity of the saturation extract is more than 4 millimhos per centimeter. This corresponds roughly to more than 0.2 percent soluble salt.

For many alkali soils, a soil amendment such as gypsum is needed as a source of calcium to replace the exchangeable sodium. The amount of calcium required, however, may come from irrigation water or from the soil. Alkali soils that have a high content of calcium carbonate can be treated with an acid—for example, sulfuric acid—or with an acid-forming material such as sulfur, which releases calcium to replace the excess sodium.

In the Cache Area, reclamation of the alkali-affected Lewiston soil seems to be fairly rapid without the use of amendments. Additions of gypsum or sulfur, however, help to hasten the reclamation process in the Airport, Quinney, and Trenton soils and the strongly alkali areas of Kirkham and Shay soils.

Soil analyses are needed to determine the kind and amount of amendments required for reclamation. The amount of a soil amendment needed for reclamation depends on the amount of sodium to be replaced by the amendment and the amount of amendments that can be obtained from the irrigation water or from the soil. Following the application of an amendment, leaching is necessary to distribute the dissolved calcium in the soil and to remove the excess salt. After the soils are reclaimed, one deep-leaching irrigation is needed each year to prevent further accumulation of salt or alkali.

Tillage.—Tillage should be kept to a minimum. Excessive tillage can destroy favorable soil structure and hasten depletion of the organic matter, and it tends to compact the soil. Tillage loosens the surface soil, at least temporarily, and causes loss of moisture. Crop residue should be left on the surface to help control erosion. Proper tillage is necessary for preparation of a good seedbed, to destroy weeds, to preserve good soil structure, and to help control erosion. Tilling the soil at the proper time is important. Some of the finer textured soils puddle and compact if they are worked when wet.

General Management for Crops on Nonirrigated Soils

The most important management practices on nonirrigated soils are controlling erosion, establishing a cropping system, and tilling the soils properly. Maintenance of organic matter and fertilization practices are common to both irrigated and nonirrigated soils.

Erosion control.—Water erosion is a serious hazard on many dryfarmed soils. Organic matter and plant nutrients are lost when erosion removes soil material from the surface layer. The water-intake rate is reduced, and the runoff rate and the rate of erosion are increased. The maintenance of organic matter in the soil is important in controlling erosion.

Practices that help to control erosion are stubble-mulch tillage or tilling in such a way that crop residue is kept on or near the soil surface, using grasses and legumes in the crop rotation, stripcropping fields, establishing a cover of grasses and legumes in the waterways and outlets, tilling and planting across the slope or on the contour, and diverting water than runs from higher areas.

The kind and intensity of these erosion control practices depends on the particular soil and site conditions. Generally, the erosion on soils that have slopes of 0 to 6 percent can be controlled by stubble-mulch tillage provided grasses and legumes are included in the cropping system. On the steeper soils, stubble-mulch tillage is supplemented by stripcropping, cross-slope tillage, diversions, and terraces.

Cropping systems.—A cropping system that maintains or increases the amount of organic matter in the soils is important. This helps to control erosion and to sustain high production over a long period of time. A common practice in the survey area is to alternate grain and fallow. Alfalfa and grasses are needed in rotation with grain and fallow to improve the soil structure, to help control erosion, and to keep the soils productive.

Most cropping systems need to be individually planned to fit the needs of the soil, the desires of the farmer, and the nature of the farming enterprise. A commonly used cropping system is small grain and fallow in alternate years for 6 years and then alfalfa or alfalfa and grass for 6 years. In some areas of high precipitation, the Mendon, Avon, Hendricks, and Nebeker soils are annually cropped to small grain. The principal small grain is winter wheat, but barley and spring wheat also are grown.

Tillage.—Tillage on dryfarmed soils, as on irrigated soils, should be kept to a minimum. Tillage should be limited to those practices that are necessary to prepare the seedbed and to control weeds.

The moisture content of the soil should be considered in planning tillage. If a soil is tilled when wet, compaction occurs. If the soil is tilled when too dry, it may pulverize too finely and later, upon wetting, become cloddy.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in the Cache Area.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils.

In the capability unit designation system used in Utah, Arabic numerals or numerals and capital letters, assigned locally, are added to the capability class and subclass designation. In the first position after the hyphen, numerals or letters refer to climatic zone; in the second position, they refer to the dominant soil and site features that influence management; in the third position (not used for some units), they refer to soil or site features that are of secondary significance in management.

Numerals are used in the first position after the hyphen for all irrigated capability units and for the nonirrigated units in the "w" subclass. Capital letters are used in this position for all other nonirrigated capability units.

Numerals and capital letters in the first position after the hyphen have meanings as follows:

2. Climatic zone that has 100 to 150 frost-free days, 12 to 20 inches of evapotranspiration, and 3,000 to 5,000 development units. A development unit is the summation of the evapotranspiration in the frost-free period expressed in centimeters multiplied by 100.

3. Climatic zone that has 70 to 100 frost-free days, 8 to 12 inches of evapotranspiration, and 2,000 to 3,000 development units.
U. Upland climatic zone, 12 to 16 inches of precipitation per year, and 9 to 14 inches of actual evapotranspiration to the soil moisture depletion date.
M. Mountain climatic zone, 16 to 22 inches of precipitation per year, and 14 to 19 inches of actual evapotranspiration to the soil moisture depletion date.
H. High Mountain climatic zone, more than 22 inches of precipitation per year.

Numerals and capital letters in the second and third positions after the hyphen have meanings as follows:

1. Historical erosion.
3. Problem or limitation caused by depth to an inhibiting layer in the soil.
4. Problem or limitation caused by low water-holding capacity attributed to gravel, cobblestones, or stones in soil material below surface layer.
5. Problem or limitation caused by slow or very slow permeability, or by poor aeration.
6. Problem or limitation caused by low water-holding capacity attributed to sandy texture of the soil.
8. Problem or limitation caused by alkali or by salts and alkali in the soil.
X. Problem or limitation caused by gravel, cobblestones, or stones on the surface of the soil.
E. Problem of erosion other than historical erosion.
C. Coniferous cover consisting of spruce and fir.
N. Maple cover.
A. Aspen cover.
Z. Actual evapotranspiration values to soil depletion date are 9 to 11 inches.

In the example IVe–MX5, nonirrigated, for the survey area, symbols have the following meanings:

IV. Capability class IV; e, subclass "e" in which the main risk is erosion; M, Mountain climatic zone; X, gravel and stones on the surface; 5, slow permeability in subsoil.

Management by capability units

In this subsection each capability unit in the survey area is described and use and management of the soils in each unit are briefly discussed. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

The capability units in class I through IV consist of soils that are well suited to irrigation and that are generally irrigated. The units in classes V through VIII consist of soils that are nonirrigated, but are used for grazing, watershed, or wildlife habitat.

CAPABILITY UNIT IIe–2, IRRIGATED

This capability unit consists of well drained and moderately well drained soils that are gently sloping and slightly undulating (slopes range from 2 to 6 percent). These soils are in the Avon, Blackrock, Crookston, Crowshaw, Hendricks, Kidman, McMurdie, Mendon, Millville, Nebeker, Parleys, Parlo, and Timpanogos series. They are on lake terraces and alluvial fans. In the areas that are not slightly undulating, the slopes are smooth.

The surface layer ranges from fine sandy loam to silty clay loam. The Blackrock soil is gravelly. Permeability of the subsoil is moderately rapid to moderately slow. These soils are generally friable and easy to till, and they absorb water readily. The silty clay loam plow layer of the Avon soil becomes slightly hard when dry, however, and it is slightly more difficult to work than the plow layer of the other soils. The available water capacity is moderately high to high. Runoff is medium to slow, and the hazard of erosion is slight to moderate. In places the Kidman and Timpanogos soils have a seasonal water table below a depth of 40 inches. The water table is generally beneficial to crops, but drainage may be required in some areas.

These soils are well suited to irrigated crops. They are used extensively for irrigated alfalfa, small grain, and improved pasture.

Land smoothing and good management of irrigation water are important practices on these soils. Obtaining uniform distribution of irrigation water is necessary. Where gravity methods of irrigation are used, intensive measures of water control are needed. Flood irrigation from contour ditches or corrugations is better for pastures and for close-growing crops than other methods of irrigation. Length of runs can range from 300 to 600 feet. These soils also are well suited to sprinkler irrigation. Rates for applying water in sprinkler irrigation range from 0.4 inch to 1.0 inch per hour.

A suitable cropping system for these soils is alfalfa or alfalfa-grass for hay or pasture for 4 or 5 years, and small grain for 2 years. Sugar beets and corn for silage can be grown occasionally in rotation with other crops. Grasses and legumes in improved pasture or meadow respond well to both nitrogen and phosphorous fertilizer.

For the soils of this unit, plowing in fall is better than plowing in spring. Crop residue should be plowed under regularly to help replenish the supply of organic matter and maintain good tilth.

CAPABILITY UNIT IIe–M, NONIRRIGATED

This capability unit consists of well-drained soils in the Avon, Hendricks, McMurdie, Mendon, and Nebeker series. These soils are nearly level to gently sloping (slopes of 0 to 6 percent), and they occur on medium and high lake terraces and alluvial fans. In general, these soils have about the same suitability for crops as those in capability units IIc–2 and IIe–2, irrigated, except that for these soils irrigation water is not available. They are in an area where the annual precipitation is 18 to 20 inches. The estimated actual evapotranspiration for the soils in this unit is 14 to 16 inches before the moisture is depleted.

The surface layer is silt loam or silty clay loam. Permeability of the subsoil is moderate to moderately slow. The soils are mainly friable and easy to till. The silty clay loam surface layer of the Avon soils is slightly more difficult to till than that of the other soils. The available water capacity is high. Runoff is medium to slow, and the erosion hazard is none to moderate.

These soils are used mainly for dryfarmed wheat and alfalfa. They are well suited to these crops.

Tilling in the fall and leaving the surface rough in winter increases the intake of water and helps to control erosion. Stubble-mulch tillage is better than other methods, for it leaves crop residue on or near the surface.

A suitable cropping system for these soils is alfalfa-grass for 6 years and wheat for 6 years. A wheat-fallow rotation also is suitable. Wheat crops respond to light applications of nitrogen if moisture is adequate in the rooting zone. Legumes respond to phosphorus.

CAPABILITY UNIT IIw-2, IRRIGATED

This capability unit consists of moderately well drained soils of the Greenson, Kirkham, Millville, and Shay series. Mainly, these soils are nearly level (0 to 3 percent slopes) and are on smooth to slightly undulating, low lake terraces, alluvial fans, and flood plains. Unless these soils are drained, the water table generally is at a depth between 30 and 40 inches. The Millville soil has a water table at a depth of slightly more than 40 inches. Some areas of the Greenson soils are moderately deep over sandy and gravelly material and have slopes of 3 to 6 percent.

Except in the Shay soil, the surface layer is loam or silt loam. Permeability of the subsoil is moderate to moderately slow. The soils are friable and easy to till, and they absorb water readily. The available water capacity is moderately high to high. Runoff is slow, and the erosion hazard is none to slight. The Shay soil has a silty clay loam surface layer that is difficult to till. It has slow permeability.

Soils of this unit are well suited to irrigated crops. Where drainage is adequate, the principal irrigated crops are alfalfa, small grain, sugar beets, and corn for silage. Improved pasture is grown in rotation on some farms. Some areas are in native vegetation and are used for grazing.

Special onsite investigation generally is needed before a drainage system is installed. Most areas of these soils have been drained, but they require maintenance of drains to control the water table. Both open-ditch and tile drains are used. About 80 feet of tile drains per acre is commonly required for adequate control of the water table. Land smoothing commonly is needed to manage irrigation water properly. For alfalfa, small grain, and pasture, the border method of irrigation is better than other methods. The length of runs should be 500 to 1,300 feet and the border width 30 to 50 feet. Furrow irrigation, using runs of 300 to 800 feet, is better for row crops than other methods. Sprinkler irrigation is well suited to these soils.

A suitable cropping system is alfalfa for 3 or 4 years, corn for silage for 1 year, and small grain for 2 years. Fertilizer generally is needed in addition to available manure and plant residue. Nitrogen or phosphorus, or both, are needed. Good tilth is easily maintained if the soils are plowed in fall, if organic matter is replenished regularly, and if the soils are not tilled or trampled when wet.

CAPABILITY UNIT IIw-26, IRRIGATED

Lewiston fine sandy loam is the only soil in this capability unit. This soil is moderately well drained and somewhat poorly drained. It has slopes of 0 to 3 percent and occurs on low lake terraces. In areas that have not been drained, the water table is mainly between depths of 20 and 40 inches.

This soil is friable and is easy to till. Permeability of the subsoil is moderately rapid, and the available water capacity is moderate. Runoff is slow to very slow, and the hazard of erosion is only slight. In places this soil is slightly to moderately affected by salts and alkali. In the past much of the acreage was subirrigated. This has caused salts and alkali to accumulate in this soil.

This soil is used mainly for irrigated alfalfa, barley, sugar beets (fig. 15), corn for silage, and improved pasture. It is well suited to these crops if it is adequately drained.

Most areas of this soil have been drained. Open-drain ditches and closed-tile drains are installed to insure the most satisfactory and most economical drainage. An average of 70 feet of tile drains per acre is adequate for controlling the level of the water table. An annual leaching irrigation generally is needed to remove excess salts and alkali. For alfalfa, small grain, and pasture, the border method of irrigation is well suited. The length of runs should be 400 to 700 feet. The furrow method of irrigation, using runs of 300 to 650 feet, is better for row crops than other methods. Sprinkler irrigation is well suited to these soils.

Considerable flexibility in cropping is possible. A suitable cropping system includes alfalfa, grass, or alfalfa-grass for hay or pasture for 4 years, corn for silage for 1 year, sugar beets for 1 year, and barley for 1 year. Fertilizer generally is needed in addition to available manure. All crops except legumes respond to phosphorus and nitrogen. Legumes respond to phosphorus.

CAPABILITY UNIT IIc-2, IRRIGATED

This capability unit consists of well-drained soils in the Avon, Crookston, Hendricks, Kidman, McMurdie, Mendon, Parleys, Parlo, and Timpanogos series. These soils have slopes of 0 to 3 percent and are on smooth to slightly undulating, medium and high lake terraces and alluvial fans.

The surface layer ranges from fine sandy loam to silty clay loam. Permeability of the subsoil ranges from moderately rapid to moderately slow. The soils are mainly friable and easy to till, and they absorb water readily. The soils that have a silty clay loam surface layer are slightly difficult to till. For most of the soils, the available water capacity is moderately high to high, but for the Parlo soil, it is moderate. Runoff is slow to medium, and the hazard of erosion is none to slight. In places the Kidman and Timpanogos soils have a seasonal water table that is below a depth of 40 inches and generally is beneficial to crops, but drainage may be required in some areas.

Soils in this unit are used mainly for irrigated crops of alfalfa, small grain, sugar beets, corn for silage (fig. 15), and improved pasture. The soils are well suited to these crops. Some areas near the town of Paradise are used for producing sugar beet seed.

Land smoothing and good management of irrigation water are important on these soils. Uniform distribution of irrigation water is necessary. The border method of irrigation is well suited to alfalfa and small grain. For row crops, the furrow method of irrigation is better than

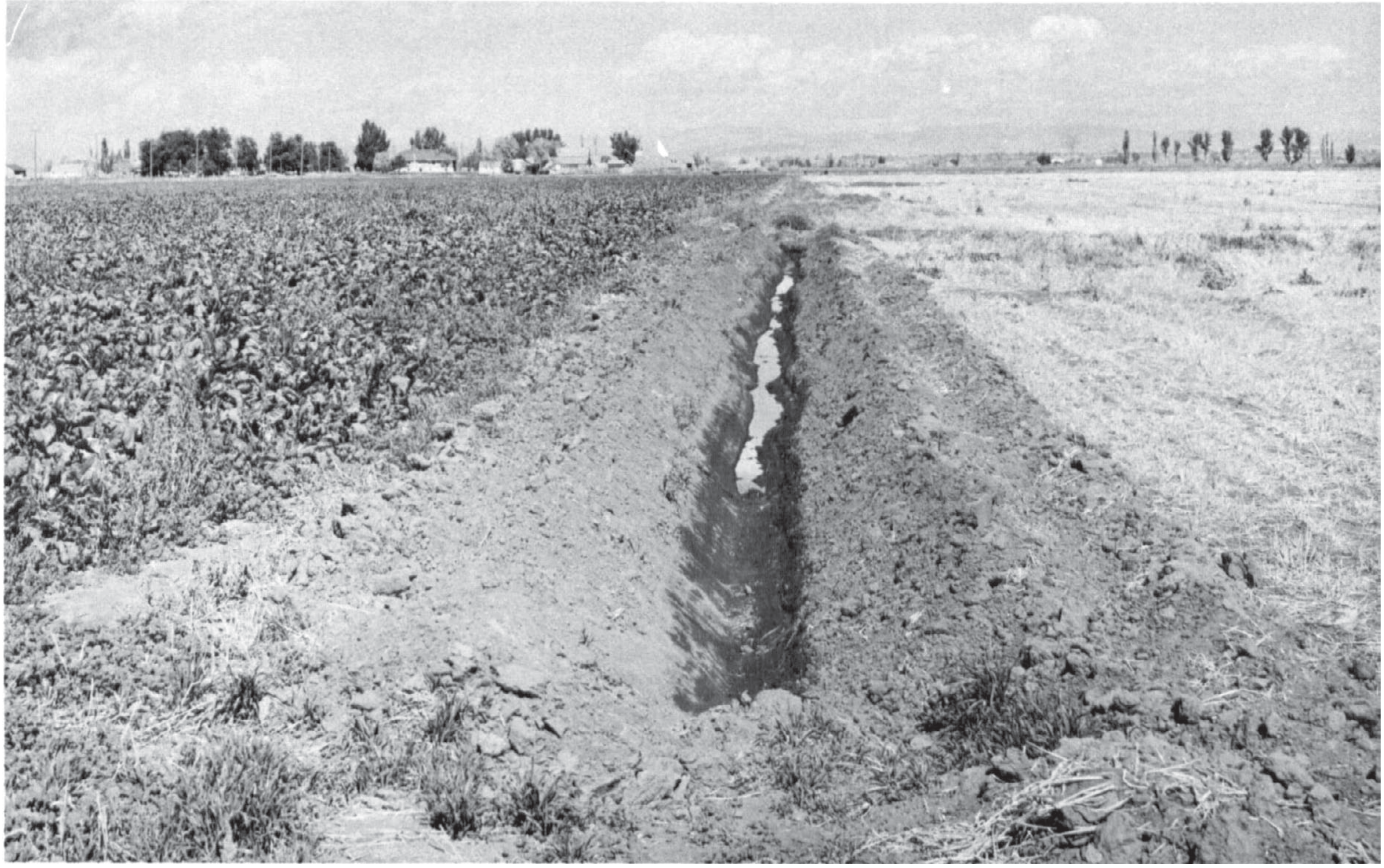

Figure 14.—**Area of Lewiston fine sandy loam in capability unit II w–26, irrigated. Sugar beets are growing in the area to the left, and small grains have been harvested from the area to the right. The ditch separating the two areas is used to provide water for subirrigation.**

other methods. The length of runs should be 300 to 700 feet for furrows, and 600 to 1,300 feet for borders. The width of borders should be 30 to 60 feet.

All crops that are suited to the climate can be grown on these soils. Considerable flexibility in crop rotation is possible. A suitable cropping system is 1 year of barley and alfalfa (using the barley with a new seeding of alfalfa), 3 years of alfalfa for hay, 1 year of corn for silage, and 1 year of sugar beets. All crops except legumes respond to nitrogen, and all crops respond to phosphorus.

Good tilth is easily maintained if the soils are plowed in fall, if the organic matter is replenished regularly, and if the soils are not tilled or trampled when wet.

CAPABILITY UNIT IIIe–2, IRRIGATED

This capability unit consists dominantly of well drained and moderately well drained soils in the Avon, Blackrock, Collinston, Crookston, Crowshaw, Dagor, Greenson, Hendricks, Kidman, McMurdie, Mendon, Nebeker, Parleys, and Timpanogos series. These soils have slopes of 4 to 10 percent and are on medium and high lake terraces and older alluvial fans. The erosion hazard is slight to moderate. Runoff is slow to medium. The Kidman and Greenson soils have a deep water table and may require some drainage. The Blackrock and Crowshaw soils are gravelly throughout.

Soils in this unit are used for irrigated crops of alfalfa, small grain, and improved pasture. They are not suited to row crops.

Where the gravity method of irrigation is used, intensive control of irrigation water is needed. Flood irrigation through contour ditches or corrugations is commonly used for close-growing crops. The length of runs should be 100 to 200 feet. Sprinkler irrigation is well suited to these soils.

A suitable cropping system is alfalfa-grass for hay or pasture for 4 or 5 years and barley for 2 years. All crops respond to phosphorus, and all except legumes respond to nitrogen.

CAPABILITY UNIT IIIe–M, NONIRRIGATED

This capability unit consists of well-drained soils in the Avon, Collinston, Dagor, Hendricks, McMurdie, Mendon, and Nebeker series. These gently undulating and strongly sloping soils (slopes of 6 to 10 percent) are on medium and high lake terraces and alluvial fans.

The surface layer is silt loam or silty clay loam. Generally, these soils are friable and easy to till, but those that have a surface layer of silty clay loam are fairly difficult to till. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is high. Permeability of the subsoil ranges from moderate to

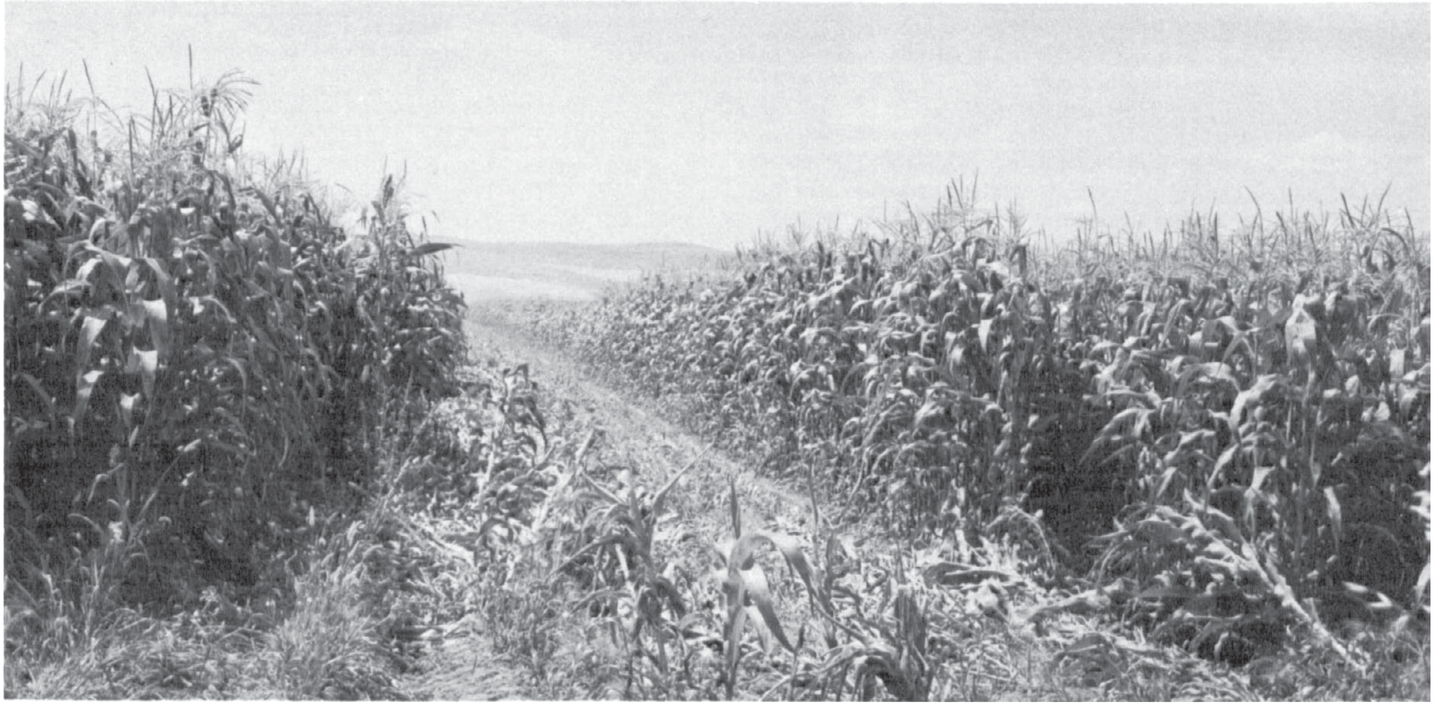

Figure 15.—**Corn for silage growing on Kidman fine sandy loam, deep water table, 0 to 2 percent slopes. This soil is in capability unit IIc-2, irrigated.**

moderately slow. Average annual precipitation is 18 to 20 inches. The estimated evapotranspiration is 14 to 16 inches before the moisture is depleted.

These soils are used for nonirrigated crops of alfalfa-grass and wheat. They are fairly well suited to wheat, barley, alfalfa, and grasses. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses.

Stubble-mulch tillage, stripcropping, contour farming, diversions, and grassed waterways conserve moisture and reduce runoff.

A suitable cropping system is alfalfa-grass hay for 6 years and fallow-winter wheat for 2 to 4 years. The wheat and fallow should be in alternate years. These soils respond to light application of nitrogen and phosphorus, especially in spring when moisture is adequate. Plowing under the last hay crop for green manure improves the soil and helps to preserve soil structure and control erosion.

CAPABILITY UNIT IIIe-MX5, NONIRRIGATED

Hiibner gravelly clay loam, 3 to 10 percent slopes, is the only soil in this capability unit. This soil is well drained and is on mountain foot slopes and high lake terraces.

This soil is moderately difficult to till because the surface layer is gravelly. Some areas are stony. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Permeability of the subsoil is slow. The available water capacity is moderate. The average annual precipitation is about 18 inches. The estimated evapotranspiration is about 14 inches before the moisture is depleted.

This soil is used for nonirrigated crops of alfalfa-grass and winter wheat. Wheat, barley, and alfalfa-grass are suitable crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses for hay or pasture. Isolated areas are used for range.

A suitable cropping system consists of wheat-fallow alternately for 5 to 6 years, then alfalfa or an alfalfa-grass mixture for hay or pasture for 4 to 6 years.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, contour farming, and grassed waterways. Special investigations are necessary to establish proper grade and intensity of these practices.

CAPABILITY UNIT IIIe-U, NONIRRIGATED

This capability unit consists of well-drained soils in the Collinston, Crookston, Mendon, Parleys, and Timpanogos series. These soils are nearly level and gently sloping (slopes of 0 to 6 percent) and are on high and medium lake terraces.

The surface layer is loam or silt loam. These soils are friable and easy to work, and they absorb moisture readily. Runoff is slow to medium, and the hazard of erosion is none to slight. The available water capacity is generally high but ranges to moderate. Permeability of the subsoil is moderate to moderately slow Average annual precipitation is 14 to 17 inches. The estimated evapotranspiration is about 12 to 14 inches before the moisture is depleted.

The soils in this unit are used for nonirrigated crops of alfalfa-grass and winter wheat. They are fairly well suited to wheat, barley, alfalfa, and grass crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in mixture with suitable grasses for hay or pasture.

Tilling in fall and leaving the surface rough increases water intake and helps control erosion. Stubble-mulch tillage is the best method of tillage because it leaves crop residue near or on the surface.

A suitable cropping system is alfalfa or alfalfa-grass for 6 years and wheat for 6 years. A wheat-fallow rotation is also suitable for these soils. Wheat crops respond to light applications of nitrogen if moisture is adequate in the root zone. Legumes respond to phosphorus.

CAPABILITY UNIT IIIe-UE, NONIRRIGATED

This capability unit consists of well-drained soils in the Crookston, Parleys, Parlo, and Timpanogos series. These soils are gently undulating and are mainly on high lake terraces and alluvial fans. Slopes range mostly from 6 to 10 percent. The Collinston soil is highly erodible and has slopes of 1 to 6 percent.

The surface layer of these soils is loam or silt loam. The soils are friable and easy to till and absorb moisture readily. Runoff is medium, and the hazard of erosion is moderate. Mainly, the soils have a moderately high to high available water capacity, but the Parleys soil has moderate available water capacity. Permeability of the subsoil is moderate to moderately slow. The average annual precipitation is 14 to 18 inches. The estimated evapotranspiration for the soils in this unit it 12 to 14 inches before the moisture is depleted.

These soils are used for nonirrigated crops of alfalfa-grass and winter wheat. Wheat, barley, alfalfa, and grasses are suitable crops. Small grain should be alternated with summer fallow because the moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses for hay or pasture.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, contour farming, diversions, and grassed waterways. Investigations and surveys are necessary to establish some of these practices.

A suitable cropping system consists of wheat and fallow alternately for 4 or 6 years, then alfalfa or an alfalfa-grass mixture for hay or pasture for 6 years. Plowing under the last hay crop for green manure improves the soil and helps to preserve the soil structure and to control erosion. Crops respond to light applications of fertilizer if moisture is adequate in spring. Small grain responds to nitrogen, and legumes respond to phosphorus.

CAPABILITY UNIT IIIe-UX, NONIRRIGATED

This capability unit consists of well-drained soils in the Blackrock, Crowshaw, and Hyrum series. These soils are gently sloping (slopes of 3 to 8 percent) and are on alluvial fans.

The surface layer is gravelly loam. These soils are fairly easy to till, but gravel causes some excessive wear on tillage implements. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderately high. Permeability of the subsoil is moderate. The average annual precipitation is 14 to 18 inches. The estimated evapotranspiration is about 11 to 12 inches before the moisture is depleted.

These soils are used mainly for dryfarmed wheat and alfalfa. They are well suited to these crops.

Tilling in fall and leaving the surface in a rough condition increases water intake and helps to control erosion. Stubble-mulch tillage is the best method of tillage because it leaves crop residue near or on the surface. A suitable cropping system is alfalfa or alfalfa and grasses for 8 years and wheat and fallow in alternate years for 6 years.

CAPABILITY UNIT IIIe-UXE, NONIRRIGATED

This capability unit consists of well-drained soils in the Blackrock and Crowshaw series. These soils have slopes of 6 to 10 percent and are on alluvial fans and medium lake terraces.

The surface layer of these soils is gravelly loam. The soils are fairly easy to till, but gravel causes excessive wear on tillage implements. Runoff is medium, and the hazard of erosion is moderate. Permeability of the subsoil is moderate. The average annual precipitation is 14 to 18 inches. The estimated evapotranspiration for soils of this unit is 11 to 12 inches before the moisture is depleted.

These soils are used mainly for nonirrigated crops of alfalfa, alfalfa-grass hay, pasture, and winter wheat. They are fairly well suited to these crops. The small grain crops are alternated with fallow.

Practices that conserve moisture and reduce runoff are stubble mulching, contour farming, stripcropping, and growing grasses and legumes in rotation.

A suitable cropping system is alfalfa-grass hay or pasture for about 6 years and wheat and fallow in alternate years for 2 to 4 years. These soils respond to small applications of fertilizer if adequate moisture is available.

CAPABILITY UNIT IIIw-2, IRRIGATED

This capability unit consists of somewhat poorly drained and poorly drained soils in the Nibley, Provo, Roshe Springs, and Winn series. These soils mainly have slopes of 0 to 3 percent, but the Nibley soil has slopes of 3 to 6 percent. They are on broad, low lake terraces and river flood plains. The depth to the water table in undrained areas ranges from 28 to 40 inches.

The surface layer of these soils is silty clay loam or silt loam. The soils that have a silty clay loam surface layer are fairly difficult to till, but those that have a silt loam surface layer are easy to till. The available water capacity is chiefly moderate to high, but the Provo soil has moderately low available water capacity. Runoff is slow to very slow, and the hazard of erosion is none to slight. Permeability of the subsoil ranges mostly from slow to moderate, but the Provo soil is gravelly below a depth of about 13 to 27 inches and its permeability is moderately rapid to rapid.

Most areas of these soils are drained and are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage. If these soils are drained, they are fairly well suited to these crops. The undrained areas are used for native pasture. Only about 25 percent of the acreage of Roshe Springs and Provo soils has been drained.

Open ditches and tile drains are used to control the water table below the root zone of alfalfa and other deep-rooted crops. For the best and most economical placement of drains, investigations generally are needed before drains are installed. Land smoothing is necessary to obtain uniform distribution of irrigation water in some areas. The border method of irrigation is best for alfalfa, small grain, and other close-growing crops. The length of runs can range from 900 to 1,320 feet. Furrow irrigation is best for row crops where runs range from 600 to 900 feet.

A suitable cropping system is alfalfa-grass hay for 3 years, corn for silage for 1 year, sugar beets for 1 year, and barley for 1 or 2 years. All crops respond to phosphorus, and all crops except legumes respond to nitrogen.

Good tilth can be maintained if the soils are plowed in fall and if organic matter is replenished regularly by manure and crop residue. Tillage and grazing should be avoided when the soils are wet.

CAPABILITY UNIT IIIw-25, IRRIGATED

This capability unit consists of somewhat poorly drained soils in the Cardon, Collett, Greenson, Logan, Salt Lake, Shay, and Woods Cross series. These soils are nearly level (slopes of 0 to 3 percent) and are on smooth to slightly undulating, low lake terraces, river flood plains, and alluvial fans.

The surface layer generally is silt loam or silty clay loam, but the Cardon soil has a silty clay surface layer. The soils that have a silty clay loam or silty clay surface layer are difficult to till, but those that have a silt loam surface layer are easy to till. Some areas are slightly affected by salt and alkali. Runoff is slow to ponded, and the hazard of erosion is none to slight. The available water capacity is moderately high to high. The permeability of the subsoil ranges from moderate to slow. The depth to the water table in undrained areas ranges mainly from 10 to 40 inches.

Most areas of these soils are used for native pasture or hay. Some areas have been drained and are used for cultivated crops of small grain and alfalfa and for improved pasture.

Open ditches and tile drains are used to control the water table below the root zone of alfalfa and other deep-rooted crops. For the best and most economical placement of drains, investigations generally are needed before drains are installed. Land smoothing is necessary to obtain a uniform distribution of irrigation water in some areas. The border method of irrigation is best for alfalfa, small grain, and other close-growing crops.

A suitable cropping system is alfalfa-grass hay for 3 years, corn for silage for 1 year, sugar beets for 1 year, and barley for 1 or 2 years. All crops respond to phosphorus, and all crops except legumes respond to nitrogen.

Good tilth can be maintained if the soils are plowed in fall and if organic matter is replenished regularly by manure and crop residue. Tillage and grazing should be avoided when the soils are wet.

CAPABILITY UNIT IIIw-28, IRRIGATED

Quinney silt loam is the only soil in this capability unit. This soil is moderately well drained and somewhat poorly drained and is strongly affected by alkali. It is slightly undulating (slopes of 0 to 3 percent) and is on low lake terraces and flood plains.

The surface layer generally is silt loam, but in small areas it is fine sandy loam. Where the surface layer is fine sandy loam, the soil is easy to till. The surface layer is slightly to moderately affected by salt and alkali, and the subsoil and substratum are strongly to very strongly affected by alkali. Runoff is slow, and the hazard of erosion is slight to none. The available water capacity is moderately high. Permeability of the subsoil is moderate to moderately slow. The depth to the water table in undrained areas ranges mainly from 30 to 50 inches.

Undrained areas of this soil are used mainly for native pasture or hay. Small areas have been drained and are used for irrigated crops of small grain and alfalfa and for improved pasture. Sugar beets and corn for silage also are grown.

Open ditches and tile drains are used to control the water table below the root zone of deep-rooted crops. For the best and most economical placement of drains, investigations generally are needed before drains are installed. Following drainage, reclamation is necessary. Large applications of manure and some amendments of gymsum or sulfur are generally needed to reclaim this soil. Land smoothing is needed to obtain a uniform distribution of irrigation water in some areas. The border method of irrigation is the best for close-growing crops. Furrow irrigation is best for row crops. A suitable cropping system is alfalfa-grass hay for 3 years, corn for silage 1 year, sugar beets for 1 year, and barley for 1 or 2 years.

CAPABILITY UNIT IIIw-3, IRRIGATED

Center Creek silt loam is the only soil in this capability unit. This soil is somewhat poorly drained. It has slopes 1 to 3 percent and is on broad, low lake bottoms.

The surface layer is silt loam and is easy to till. Runoff is slow to very slow, and the hazard of erosion is none to slight. The available water capacity is high. Permeability of the subsoil is moderately slow. The depth to the water table fluctuates considerably but ranges from a depth of 28 to 40 inches during most of the growing season.

The soil is used for alfalfa, small grain, and native pasture. It is fairly well suited to those crops.

Controlling the water table and good management of water are important.

Good tilth can be maintained if the soil is plowed in fall and if organic matter is replenished regularly by manure and crop residue. Tillage and grazing should be avoided when the soil is wet.

CAPABILITY UNIT IIIs-24, IRRIGATED

This capability unit consists of well drained and moderately well drained soils in the Collinston and Layton series. These soils have slopes of 0 to 3 percent and are on smooth to slightly undulating, medium lake terraces.

The surface layer of these soils is loamy fine sand. The soils are very friable and easy to till, and they absorb water readily. Runoff is slow, and the hazard of erosion is slight. The available water capacity is moderately low. Permeability of the subsoil is rapid. Unless the Layton soil is drained, the water table is mainly at a depth of 36 to 45 inches during the irrigation season.

These soils are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage.

Careful control of irrigation water is very important. Some areas may require drains. Land smoothing is needed in some areas unless they are sprinkler irrigated. The border method of irrigation is suitable for close-growing crops. The length of runs ranges from 300 to 600 feet. Where row crops are grown, the furrow method is well suited and runs can range from 250 to 500 feet. The soils are well suited to sprinkler irrigation. The rate of water application can range from 0.7 to 1.5 inches per hour.

A suitable cropping system is grass-legume hay or pasture for 4 or 5 years, corn for 1 year, sugar beets for 1 year, and small grain for 1 or 2 years. All crops except legumes respond to nitrogen. All crops respond to phosphorus.

Plowing can be done either in spring or in fall. Good tilth is easily maintained if organic matter is replenished regularly by additions of manure and crop residue.

CAPABILITY UNIT IIIs-25, IRRIGATED

Battle Creek silty clay loam, 0 to 2 percent slopes, is the only soil in this capability unit. This soil is well drained. It is on lake terraces.

The surface layer is silty clay loam, and the soil is moderately difficult to till. It compacts if tilled when wet. Runoff is slow, and the hazard of erosion is none to slight. The available water capacity is high. The subsoil has slow permeability.

This soil is well suited to irrigated crops of alfalfa, small grain, corn for silage, and for improved pasture. It is only fairly well suited to sugar beets.

In some areas land smoothing is needed for uniform distribution of water to all parts of the field. Sprinkler irrigation is used in many areas and is better suited to these soils than other methods. Border irrigation can be used for close-growing crops, and the length of runs can range from 1,000 to 1,300 feet. Furrow irrigation can be used, and runs can range from 500 to 1,100 feet. The surface layer is compacted if it is tilled or plowed when wet. Plowing in fall and proper timing of operations in spring are necessary to avoid compaction. A suitable cropping system is alfalfa for 3 years, corn for silage for 1 year, and small grain for 1 or 2 years. Crops respond to nitrogen, phosphorus, or both, depending on the crop and the cropping history.

CAPABILITY UNIT IIIs-U4, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils in the Collinston and Parlo series. These soils are nearly level to gently sloping (slopes of 0 to 6 percent) and are on medium lake terraces. The Parlo soils are 28 to 40 inches deep over gravel and sand.

The surface layer of the soils in this unit ranges from loamy fine sand to silt loam. The soils are friable and easy to till. Runoff is very slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderate. Permeability of the subsoil ranges from moderate to rapid. Average annual precipitation is 14 to 18 inches. The estimated evapotranspiration is 12 to 14 inches before the moisture is depleted.

These soils are used mainly for nonirrigated crops of alfalfa-grass and winter wheat. Wheat, barley, alfalfa, and grasses are suitable crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture of suitable grasses for hay or pasture.

Tilling in fall and leaving the surface in a rough condition increases water intake and helps to control erosion. Stubble-mulch tillage is better than other methods because it leaves crop residue near or on the surface. A suitable cropping system is alfalfa or alfalfa-grass for 8 years and wheat alternated with fallow for 6 years. Wheat responds to light applications of nitrogen if moisture is adequate in the root zone. Legumes respond to phosphorus.

CAPABILITY UNIT IIIs-U5, NONIRRIGATED

Battle Creek silty clay loam, 0 to 2 percent slopes, is the only soil in this capability unit. This soil is well drained. It is on gently undulating, medium lake terraces.

The surface layer is a silty clay loam. The soil is moderately difficult to till and compacts if tilled when wet. Runoff is slow, and the hazard of erosion is none to slight. The available water capacity is high. Permeability of the subsoil is slow. Average annual precipitation is 14 to 17 inches. The estimated evapotranspiration is 12 to 14 inches before the moisture is depleted.

This soil is used mainly for nonirrigated crops of alfalfa and small grain. It is fairly well suited to these crops.

Tilling in fall and leaving the surface in a rough condition increases water intake and helps to control erosion. Stubble-mulch tillage is better than other methods because it leaves crop residue near the surface. A suitable cropping system is alfalfa or alfalfa and grasses for 8 years and wheat and fallow in alternate years for 8 years.

CAPABILITY UNIT IIIs-U8, NONIRRIGATED

This capability unit consists of moderately well drained soils of the Trenton series that are affected by alkali. These soils have slopes of 0 to 8 percent and are on low lake terraces.

The surface layer of these soils is silty clay loam. Generally, the surface layer only is slightly affected by alkali, but the subsoil and substratum are strongly affected. The soils are fairly difficult to till except at optimum moisture content. Runoff is slow, and the hazard of erosion is slight. The available water capacity is moderately high. Permeability of the subsoil is slow. The water table is below a depth of 40 inches. Average annual precipitation is 14 to 17 inches. The estimated evapotranspiration is 11 to 12 inches before the moisture is depleted.

These soils are used mainly for dryfarmed crops. Wheat, barley, alfalfa, and grass are suitable crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses for hay or pasture.

The management practices for moisture conservation include selection of crops and rotations that are suited to the moisture supply.

A suitable cropping system is alfalfa or alfalfa-grass for 6 years and small grain and fallow in alternate years for 6 years. Stubble-mulch tillage is better than other methods because it leaves crop residue on the surface. Crops generally respond to small amounts of nitrogen, phosphorus, or both, depending on the availability of adequate moisture.

CAPABILITY UNIT IVe-2, IRRIGATED

This capability unit consists of well-drained soils in the Avon, Battle Creek, Dagor, Hendricks, Kidman, and Timpanogos series. These soils have slopes of 8 to 20 percent and are on alluvial fans and medium and high lake terraces.

The surface layer ranges from fine sandy loam to silty clay loam. The soils that have a silty clay loam surface layer are slightly difficult to till, but the other soils are friable and easy to till. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The available water capacity is moderately high to high. Permeability of the subsoil ranges from moderately rapid to moderately slow.

These soils are used mainly for irrigated crops of alfalfa, small grain, and improved pasture. They are not suited to row crops. Where these soils are irrigated, intensive practices must be used to control erosion.

Sprinkler irrigation is better suited than other methods. The slopes are too steep for the gravity method of irrigation except for furrow irrigation on the contour or across the slope.

CAPABILITY UNIT IVe-M, NONIRRIGATED

This capability unit consists of well-drained soils in the Avon, Collinston, Dagor, Hendricks, McMurdie, and Nebeker series. These soils have slopes of 10 to 20 percent and are on lake terraces and alluvial fans.

The surface layer of these soils is silt loam or silty clay loam. The soils are mainly fairly easy to till, but those that have a silty clay loam surface layer are slightly difficult to till except at optimum moisture content. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is high. Permeability of the subsoil is moderate or moderately slow. Average annual precipitation is 18 to 20 inches. The estimated evapotranspiration is 14 to 16 inches before the moisture is depleted.

These soils are used mainly for nonirrigated crops of alfalfa-grass and winter wheat. They are fairly well suited to these crops.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, contour farming, and constructing diversions and grassed waterways. Surveys are necessary to establish these practices. A suitable cropping system is alfalfa-grass hay or pasture for 6 years and winter wheat and fallow for 2 to 4 years.

CAPABILITY UNIT IVe-MX5, NONIRRIGATED

Hiibner gravelly clay loam, 10 to 20 percent slopes, is the only soil in this capability unit. This soil is well drained. It is on foot slopes of mountains and high lake terraces.

Some areas of this soil are stony. Fertility is moderate. The soil is moderately difficult to till because of the gravel and cobblestones. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is moderate. Average annual precipitation is 18 to 20 inches. The estimated evapotranspiration is about 14 inches before the moisture is depleted.

This soil is mainly used for range, but it is fairly well suited to an occasional dryfarmed crop. Alfalfa, wheat, and barley are suitable crops.

Practices that conserve moisture and reduce runoff include stubble mulching, stripcropping, contour farming, diversions, and grassed waterways. Investigations are necessary to establish most of these practices. A suitable cropping system is alfalfa-grass hay or pasture for 6 years and winter wheat and fallow for 2 to 4 years.

CAPABILITY UNIT IVe-U, NONIRRIGATED

This capability unit consists of well-drained soils of the Collinston and Timpanogos series. These soils are mainly moderately steep (slopes of 10 to 20 percent) and are on alluvial fans and medium lake terraces. The Collinston soil is highly erodible. It is strongly sloping (slopes of 6 to 10 percent) and generally rolling.

These soils are friable and easy to till. Runoff is medium, and the hazard of erosion is moderate. The soils have a high to moderately high available water capacity. Permeability is moderate. Average annual precipitation is 14 to 18 inches. The estimated evapotranspiration is 12 to 14 inches before the moisture is depleted.

The soils in this unit are used mainly for dryfarmed crops. Wheat, barley, alfalfa, and grass are suitable crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses for hay or pasture. A suitable cropping system is alfalfa or alfalfa-grass for 8 years and grain and fallow in alternate years for 2 to 4 years.

Tillage practices that leave crop residue on the surface are desirable. Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, contour farming, and constructing diversions and grassed waterways. Special investigations generally are necessary to establish these practices.

CAPABILITY UNIT IVe-U5, NONIRRIGATED

Battle Creek silty clay loam, 8 to 15 percent slopes, is the only soil in this capability unit. This soil is well drained. It is on lake terraces.

This soil is moderately difficult to till. The surface layer is silty clay loam. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is high. Permeability of the subsoil is slow. Average annual precipitation is 12 to 14 inches. The estimated evapotranspiration is 12 to 14 inches before the moisture is depleted.

This soil is used mainly for nonirrigated crops of alfalfa, alfalfa-grass for hay, winter wheat, and pasture. It is fairly well suited to these crops, but should be kept in permanent cover most of the time.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, and growing of grasses and legumes in rotation.

CAPABILITY UNIT IVe-U8, NONIRRIGATED

Trenton silty clay loam, 8 to 20 percent slopes, eroded, is the only soil in this capability unit. This soil is moderately well drained and is alkali affected. It is on long, narrow, low lake terrace escarpments and is moderately eroded.

This soil is fairly difficult to till. The surface layer is silty clay loam. Generally, the surface layer is only slightly affected by alkali, but the subsoil and substratum are affected by salts and alkali. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The available water capacity is moderately high. The subsoil permeability is slow. Generally, the water table is below a depth of 40 inches. Average annual precipitation is 14 to 17 inches. The estimated evapotranspiration is 11 to 12 inches before the moisture is depleted.

This soil is used for range and for dryfarmed crops of alfalfa and small grain. Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, and growing of grasses and legumes in rotation.

CAPABILITY UNIT IVe-UX, NONIRRIGATED

This capability unit consists of well-drained soils in the Blackrock, Crowshaw, and Hyrum series. These soils have slopes of 10 to 25 percent and are on alluvial fans and medium lake terraces.

The surface layer of these soils is a gravelly loam. The soils are friable and fairly easy to till, but the gravel causes excessive wear on tillage implements. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The available water capacity is moderate to moderately high. Permeability of the subsoil is moderate. Average annual precipitation is 14 to 18 inches. The estimated evapotranspiration is 10 to 12 inches before the moisture is depleted.

These soils are used mainly for dryfarmed crops of alfalfa, wheat, and barley. They are fairly well suited to these crops.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, and growing grass and legume in rotation. A suitable cropping system is alfalfa-grass hay or pasture for 6 to 8 years and wheat and fallow in alternate years for 2 or 3 years.

CAPABILITY UNIT IVw-28, IRRIGATED

This capability unit consists of somewhat poorly drained soils that are affected by alkali. These soils are in the Airport, Kirkham, Lewiston, Salt Lake, Shay, and Trenton series. They have slopes mainly of 0 to 4 percent, but one of the Trenton soils is on low lake terraces and has slopes of 4 to 8 percent.

The surface layer of these soils is silty clay, silty clay loam, silt loam, or fine sandy loam. The Airport, Salt Lake, Shay, and Trenton soils are fairly difficult to till because of their silty clay loam or silty clay surface layer. The surface layer of all the soils generally is only slightly affected by alkali, but the subsoil and substratum are moderately to strongly affected. Runoff is slow to ponded, and the hazard of erosion is only slight. The available water capacity is moderate to moderately high. Permeability of the subsoil is very slow to moderately rapid. The water table generally is at a depth of 20 to 40 inches.

If these soils are drained and partially reclaimed, they are suited to irrigated barley for improved pasture, but most areas are used for unimproved pasture.

Investigations are necessary to determine the feasibility of improving drainage because the soils commonly are in low areas that have limited outlets. After drainage, applications of gypsum and manure help to speed reclamation, and an application at least once each year helps to keep the salt concentration from increasing in the root zone. Land smoothing is necessary in some areas to obtain a uniform distribution of irrigation water. Border irrigation is better than other methods of surface irrigation, and the length of runs can range from 600 to 1,000 feet. Sprinkler irrigation is an alternate method. Deep cuts should be avoided when leveling to prevent exposing the saline and alkali subsoil.

A suitable cropping system for these soils is a grass-legume mixture for hay or pasture for 4 to 6 years followed by barley for 1 or 2 years. All crops should be species that are tolerant of salt and alkali. Fertilizer generally is needed.

CAPABILITY UNIT IVs-24, IRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils in the Green Canyon, Lakewin, Preston, Ricks, Steed, and Sterling series. These soils generally have slopes of 0 to 10 percent, but one of the Sterling soils has slopes of 10 to 20 percent. Soils in this unit are on alluvial fans and medium lake terraces.

The surface layer is chiefly a gravelly loam, but the Preston soil has a surface layer of fine sand and is highly susceptible to blowing. All the soils are fairly easy to till, but gravel causes excessive wear on tillage implements. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderately low to low.

These soils are used mainly for irrigated alfalfa and small grain, but fruit trees are grown in areas where good air movement reduces the hazard of damage from frost. These soils are fairly well suited to these crops.

Some areas need land smoothing, where surface irrigation methods are used. Deep cuts should be avoided in land leveling, as the very gravelly underlying material may be exposed. Sprinkler irrigation is better than other methods on these soils.

A suitable cropping system is 4 to 6 years of a grass-legume mixture for hay or pasture and 2 years of small grain. Good tilth can be maintained if the soils are plowed in fall, if organic matter is replenished regularly, and if the soils are not tilled or plowed when wet. The crops respond to frequent application of nitrogen, phosphorus, or both.

CAPABILITY UNIT Vw-2, NONIRRIGATED

This capability unit consists of somewhat poorly and poorly drained soils in the Provo, Roshe Springs, Salt Lake, and Trenton series and Mixed alluvial land. These soils have slopes of 0 to 1 percent and are on stream bottoms and flood plains in depressional areas.

The surface layer ranges from silt loam to fine sandy loam or silty clay. Runoff is slow to ponded, and the hazard of erosion is none to slight. The available water capacity is moderate. Permeability of the subsoil is moderate to very slow. The water table ranges from deep to shallow, and overflow is frequent.

These soils are used for pasture or hay. They are not suitable for cultivation. These soils can be reseeded to improved grasses or fertilized to increase production.

CAPABILITY UNIT VIe-HA, NONIRRIGATED

This capability unit consists of well-drained soils in the Flygare, Lucky Star, Mult, Red Spur, and Scave series. These soils have slightly convex to slightly rolling slopes of 3 to 30 percent and are on flood plains, alluvial fans, and mountains.

The surface layer of these soils is silt loam or loam and is gravelly in places. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Permeability of the subsoil is moderate. Average annual precipitation is 25 to 30 inches.

These soils are used mainly for watershed, range, and wildlife habitat, but they are used to some extent as woodland and for harvesting of aspen trees. They are not suitable for cultivation.

CAPABILITY UNIT VIe-HC, NONIRRIGATED

This capability unit consists of well-drained soils in the Cluff, Elwood, and Scout series. These soils have slopes that range from 6 to 40 percent, and they are on mountains.

The surface layer ranges from silt loam to very fine sandy loam or gravelly loam. Runoff is slow to rapid, and the hazard of erosion is slight to high. The available water capacity is moderate. Permeability of the subsoil is moderate to moderately rapid. Average annual precipitation is 25 to 35 inches.

These soils are used mainly for watershed, wildlife habitat, and range. Some areas have been used for harvesting Douglas-fir and other trees. These soils are unsuitable for cultivation.

The vegetation is mainly alpine fir, Douglas-fir, and aspen.

CAPABILITY UNIT VIe-M, NONIRRIGATED

This capability unit consists of well-drained soils in the Ant Flat, Despain, Goring, Hoskin, and Smarts series. These soils have slightly concave slopes of 6 to 30 percent and are on mountains and lake terraces.

The surface layer of these soils ranges from silty clay loam to gravelly loam. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderately high to high. Permeability of the subsoil is moderate to slow. Average annual precipitation is 18 to 25 inches.

Nearly all of the acreage is used for range, wildlife habitat, and watershed. Where the plant cover is in poor condition, the soils can be reseeded to grasses and legumes. Intermediate wheatgrass and alfalfa generally are used in seeding. These soils are unsuitable for cultivation.

CAPABILITY UNIT VIe-M5, NONIRRIGATED

This capability unit consists of well-drained soils in the Ant Flat, Goring, and Obray Series. These soils have slightly concave slopes of 1 to 30 percent and are on mountains, broad alluvial fans, and ridges.

The surface layer of these soils is silty clay loam or silty clay. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is high. Permeability of the subsoil is slow to very slow. Average annual precipitation is 18 to 25 inches.

These soils are used for range, watershed, and wildlife habitat. In most areas the vegetation has been depleted. Where the vegetation is in poor condition, the soils should be reseeded to grasses. Intermediate wheatgrass and some alfalfa generally are used in seeding. These soils are unsuitable for cultivation.

CAPABILITY UNIT VIe-MN, NONIRRIGATED

This capability unit consists of well-drained soils in the Clegg and LaPlatta series. These soils have slopes of 6 to 30 percent and are on mountains and alluvial fans. The climate severely restricts crop growth and the kind of crops that can be grown.

The surface layer of these soils is loam, silt loam, or silty clay loam, and it has a moderately high organic-matter content. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderately high. Permeability of the subsoil ranges from slow to moderate. Average annual precipitation is 18 to 26 inches.

These soils are used mainly for range, watershed, and wildlife habitat. They are not suitable for cultivation.

Where the plant cover is in poor condition, the soils can be reseeded to grasses and legumes. Intermediate wheatgrass and alfalfa generally are used in seeding. The Clegg soil requires clearing before it can be seeded.

CAPABILITY UNIT VIe-MX5, NONIRRIGATED

Hiibner gravelly clay loam, 20 to 30 percent slopes, is the only soil in this capability unit. This soil is well drained and is on foot slopes of mountains and high lake terraces.

Some areas of this soil are stony. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is moderate. Permeability of the subsoil is slow. Average annual precipitation is 18 to 20 inches.

This soil is used for range, watershed, and wildlife habitat. Where the vegetation is in poor condition, the soil should be reseeded to grasses and legumes. Intermediate wheatgrass and alfalfa are suitable for reseeding. This soil is not suitable for cultivation.

CAPABILITY UNIT VIe-U, NONIRRIGATED

This capability unit consists of well-drained soils in the Collinston, Hillfield, Mendon, and Timpanogos series. These soils have slopes of 6 to 30 percent and are on terrace escarpments and fans.

The surface layer of these soils is loam. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderate. Permeability of the subsoil is moderate. Average annual precipitation is 15 to 20 inches.

These soils are used mostly for range. They are better suited to range or reseeding to grass or grass and legumes than to other uses.

CAPABILITY UNIT VIe-U1, NONIRRIGATED

This capability unit consists of well-drained soils in the Collinston and Wheelon series. These soils have slightly convex, rolling slopes of 10 to 30 percent.

The surface layer of these soils is silt loam to loam. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The available water capacity is moderate. Permeability of the subsoil is moderate. Average annual precipitation is about 17 inches.

All of the acreage is used for range, wildlife habitat, and watershed. Where the plant cover is in poor condition, the soils should be reseeded to grasses and legumes. Intermediate wheatgrass and alfalfa generally are used in seeding.

CAPABILITY UNIT VIs-U4, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils in the Green Canyon, Lakewin, Ricks, Steed, and Sterling series. These soils are on narrow lake-terrace escarpments and fans. They have slopes that range from 0 to 20 percent.

The surface layer of these soils is gravelly loam. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is moderately low. Permeability of the subsoil is moderately rapid to rapid. Average annual precipitation is about 16 inches.

Most of the acreage is used for range and watershed. Some areas have been used for dryfarmed wheat and alfalfa, but crop growth is very poor. In areas that have been cultivated or where the native plant cover is in poor condition, the soils should be reseeded to grass. Crested wheatgrass generally is used for reseeding.

CAPABILITY UNIT VIIe-HA, NONIRRIGATED

This capability unit consists of well-drained soils in the Lucky Star, Mult, and Scave series. These soils generally have slopes of 30 to 70 percent and are on mountains. The Lucky Star soils are very cobbly. Scave extremely rocky silt loam, 10 to 30 percent slopes, is included in this capability unit because of its small acreage.

The surface layer generally is silt loam or gravelly silt loam. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderate to high. Permeability of the subsoil is moderate. Average annual precipitation is 25 to 35 inches.

These soils are used mainly for watershed, range, wildlife habitat, and woodland.

CAPABILITY UNIT VIIe-HC, NONIRRIGATED

This capability unit consists of well-drained soils in the Bickmore, Dateman, Elwood, and Scout series. These soils have slopes of 30 to 80 percent and are on mountains.

The surface layer is silt loam to gravelly, cobbly, or stony silt loam or loam. Some areas of Dateman soils are extremely rocky. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderate. Permeability of the subsoil is moderate to moderately rapid. Average annual precipitation is 25 to 30 inches.

These soils are used for watershed, woodland, wildlife habitat, and range. Douglas-fir has been harvested in some areas.

CAPABILITY UNIT VIIe-M, NONIRRIGATED

This capability unit consists of well-drained soils in the Despain, Goring, Nebeker, and Picayune series. These soils have slopes of 30 to 70 percent and are on mountains.

The surface layer of these soils is silt loam or gravelly loam. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderately high to high. Permeability of the subsoil ranges from moderate to slow. Average annual precipitation is 20 to 24 inches.

These soils are used for range, wildlife habitat, and watershed.

CAPABILITY UNIT VIIe-M4, NONIRRIGATED

This capability unit consists of well-drained soils that are on mountains and have slopes of 30 to 80 percent. These soils are in Bradshaw, Datwyler, Hoskin, Picayune, Poleline, Sheep Creek, and St. Marys series.

The surface layer ranges from gravelly loam, loam, or cobbly loam to cobbly silty clay loam. The content of organic matter in the surface layer is moderate to moderately high. Permeability of the subsoil is moderate to moderately low. Available water capacity is moderate to moderately low. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Average annual precipitation is 16 to 25 inches.

These soils are used mainly for range, wildlife habitat, and watershed.

CAPABILITY UNIT VIIe-MN, NONIRRIGATED

This capability unit consists of well-drained soils in the Barfuss, Elzinga, LaPlatta, Maughan, and Smarts series. These soils have mainly north-facing slopes of 30 to 70 percent and are on mountains.

The surface layer ranges from silt loam or gravelly silt loam to silty clay loam or gravelly loam. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderately high to high. Permeability of the subsoil is slow to moderately rapid. Average annual precipitation is 20 to 30 inches.

These soils are used for watershed, range, and wildlife habitat.

CAPABILITY UNIT VIIe-U, NONIRRIGATED

This capability unit consists of well-drained soils in the Leatham series and Rough broken land. These steep to very steep soils (slopes of 30 to 60 percent) are on foothills and mountains.

The surface layer is loam or silt loam. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderately high to high. Permeability of the subsoil is moderate. Average annual precipitation is about 18 inches.

These soils are used for watershed, range, and wildlife habitat.

CAPABILITY UNIT VIIe-U1, NONIRRIGATED

Wheelon silt loam, 30 to 50 percent slopes, eroded, is the only soil in this capability unit. This well-drained soil has steep, slightly convex, rolling slopes.

The surface layer generally is silt loam, but in small areas it is loam. Runoff is rapid, and the hazard of erosion is high. The available water capacity is moderate. Permeability of the subsoil is moderate. Average annual precipitation is about 17 inches.

All of the acreage is used for range, wildlife habitat, and watershed. Where the plant cover is in poor condition, the soil should be reseeded to grasses and legumes.

CAPABILITY UNIT VIIw-285, NONIRRIGATED

This capability unit consists of somewhat poorly drained soils that are affected by salt and alkali. These soils are in the Jordon, Lasil, and Payson series. They have slopes of 0 to 1 percent and are on low lake terraces.

The surface layer is silt loam or silty clay loam. The effect of salt and alkali is strong or very strong. Runoff is slow, and the hazard of erosion is none to slight. The available water capacity is moderately high. Permeability of the subsoil is slow or very slow. The depth to the water table is 30 to 48 inches.

These soils are used mainly for range. Some areas have been cultivated, although the soils are poorly suited to crops.

CAPABILITY UNIT VIIs-HXC, NONIRRIGATED

Fitzgerald extremely stony loam, 10 to 20 percent slopes, is the only soil in this capability unit. This well-drained soil is on mountains and in valleys.

Runoff is slow on this soil, and the hazard of erosion is slight. The available water capacity is moderate. Permeability is moderate. Average annual precipitation is 25 to 35 inches.

This soil is used mainly for watershed, woodland, wildlife habitat, and range.

CAPABILITY UNIT VIIs-MX3, NONIRRIGATED

This capability unit consists of somewhat excessively drained soils in the Agassiz, Curtis Creek, and Foxol series. These soils have slopes of 6 to 70 percent and are on mountains.

The surface layer is cobbly to extremely stony or rocky loam or silt loam. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. The available water capacity is low. Permeability is moderate to moderately rapid. Average annual precipitation is 18 to 27 inches.

These soils are used for range, watershed, and wildlife habitat.

CAPABILITY UNIT VIIs-MX4, NONIRRIGATED

This capability unit consists of well-drained soils in the Yeates Hollow series. These soils have slopes of 6 to 70 percent and are on alluvial fans and mountains.

The surface layer is extremely stony silty clay loam or silt loam. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. The available water capacity is moderate. Permeability of the subsoil is slow. Average annual precipitation is 20 to 25 inches.

These soils are used for range, water supply, and wildlife habitat.

CAPABILITY UNIT VIIs-MX5, NONIRRIGATED

This capability unit consists of well-drained soils in the Hiibner and Yeates Hollow series. These soils have slopes of 1 to 30 percent and are on alluvial fans and mountains.

The surface layer is extremely stony silty clay loam or silt loam. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderate. Permeability of the subsoil is slow. Average annual precipitation is 20 to 24 inches.

These soils are used for range, water supply, and wildlife habitat.

CAPABILITY UNIT VIIs-UX3, NONIRRIGATED

This capability unit consists of somewhat excessively drained soils in the Richmond series. These soils have slopes of 30 to 70 percent and are on mountains.

The surface layer ranges from very stony loam to gravelly very fine sandy loam. Some areas are rocky. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is very low. Permeability of the subsoil is moderately rapid. Average annual precipitation is 15 to 20 inches.

These soils are used mainly for range, watershed, and wildlife habitat.

CAPABILITY UNIT VIIs-U4, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained Blackrock, Middle, Munk, and Sterling soils and Stony alluvial land. These soils are mostly on long, narrow lake-terrace escarpments, foothills, and mountains. Slopes range mostly from 20 to 70 percent.

The surface layer of these soils is cobbly loam, gravelly loam, or extremely stony loam. Most areas have rock outcrops. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. The available water capacity is moderately low. Permeability of the subsoil is moderate to moderately rapid. Average annual precipitation is 15 to 20 inches.

These soils are used mainly for range, watershed, and wildlife habitat.

CAPABILITY UNIT VIIIw-28, NONIRRIGATED

Cache silty clay is the only soil in this capability unit. This is a poorly drained, fine-textured soil that is affected by salt. This nearly level soil is on valley bottoms. It is inundated by water at times during the year. This soil is bare, except for scattered patches of saltgrass and pickleweed. It is of little or no value for farming.

CAPABILITY UNIT VIIIw-4, NONIRRIGATED

This capability unit consists of very gravelly and cobbly areas of Riverwash along or adjacent to permanent streams. This land type has low available water capacity, and frequent overflow very severely restricts its use. It is generally not suitable for cropping, and lack of a cover of plants prohibits its use for range.

CAPABILITY UNIT VIIIs-4, NONIRRIGATED

Gravel pit is the only mapping unit in this capability unit. This land type consists of very gravelly and cobbly soil material in gravel pits. This material is used mostly as a source of gravel and sand for concrete or other construction. It has little or no vegetation growing on it, and it is of no value for farming.

CAPABILITY UNIT VIIIs-X, NONIRRIGATED

This capability unit consists of Rock land and rock outcrops. The acreage is large, but individual areas are comparatively small and are dispersed throughout the mountains and foothills. The areas have little or no vegetation. They are not suitable for farm use, but are suitable for wildlife shelter. The adjacent soils provide food and cover for wildlife.

Estimated Yields

Table 2 gives the estimated average acre yields of the principal crops and pasture grown on cultivated soils in the survey area. Yields are given for the main crops grown under irrigation and for nonirrigated alfalfa, wheat, and barley. These yields are estimated on the basis of information obtained from farmers, district conservationists of the Soil Conservation Service, the county agricultural extension agent, the local office of the Agricultural Stabilization and Conservation Service, and census reports. If no information was available for a particular soil, the estimates were made on the basis of yields on a similar soil. The estimates are given for one level of management, which is defined in the following paragraphs.

To obtain the yields for irrigated crops listed in table 2, the following management practices should be used: The soils are leveled and adequately drained. Structures for efficient use of irrigation water are adequate. The method of irrigation, size of streams, and length of irrigation runs are adjusted to the estimated intake rate of

TABLE 2.—*Estimated average acre yields of principal crops*

[Absence of yield indicates crop is not generally grown or is not suited to the soil. Range and woodland soils and miscellaneous land types that are not listed are normally not suitable for the crops named. Yields from wet soils and from soils affected by salt and alkali are obtained after adequate drainage and reclamation practices have been applied]

Mapping units	Irrigated crops						Nonirrigated crops		
	Alfalfa	Wheat	Barley	Sugar beets	Corn for silage	Pasture	Alfalfa	Wheat	Barley
	Tons	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Tons*	*Bu.*	*Bu.*
Airport silt loam, 0 to 3 percent slopes	3.5	30	55	15	18	200	1.5	-------	40
Airport silty clay loam	3.0	30	50	15	16	200	1.5	-------	40
Avon silty clay loam, 0 to 3 percent slopes	6.0	65	80	-------	-------	275	2.5	40	45
Avon silty clay loam, 3 to 6 percent slopes	5.0	65	80	-------	-------	275	2.5	40	45
Avon silty clay loam, 6 to 10 percent slopes	-------	-------	-------	-------	-------	-------	2.0	35	-------
Avon silty clay loam, 10 to 20 percent slopes	4.0	50	-------	-------	-------	-------	2.0	30	-------
Battle Creek silty clay loam, 0 to 2 percent slopes	6.0	75	85	21	20	275	2.0	40	35
Battle Creek silty clay loam, 8 to 15 percent slopes	-------	-------	-------	-------	-------	250	2.0	35	30
Blackrock gravelly loam, 3 to 6 percent slopes	-------	-------	-------	-------	-------	-------	2.0	35	35
Blackrock gravelly loam, 6 to 10 percent slopes	-------	-------	-------	-------	-------	-------	1.7	30	35
Blackrock gravelly loam, 10 to 20 percent slopes	-------	-------	-------	-------	-------	-------	1.5	25	-------
Cardon silty clay	4.5	65	75	15	18	275	-------	-------	-------
Collett silty clay loam	5.0	65	75	20	20	275	-------	-------	-------
Collinston loam, 1 to 6 percent slopes	-------	-------	-------	-------	-------	-------	1.5	20	20
Collinston loam, 6 to 10 percent slopes	-------	-------	-------	-------	-------	-------	1.5	20	20
Collinston loamy fine sand, 0 to 3 percent slopes	-------	-------	-------	-------	-------	-------	1.5	22	22
Crookston loam, 0 to 3 percent slopes	6.0	65	80	18	20	275	2.5	40	45
Crookston loam, 3 to 6 percent slopes	5.0	65	80	-------	-------	275	2.5	35	40
Crookston loam, 6 to 10 percent slopes	4.5	60	-------	-------	-------	-------	2.0	35	35
Crowshaw gravelly loam, 3 to 6 percent slopes	-------	-------	-------	-------	-------	-------	2.0	40	45
Crowshaw gravelly loam, 6 to 10 percent slopes	-------	-------	-------	-------	-------	-------	2.0	40	45
Crowshaw gravelly loam, 10 to 20 percent slopes	-------	-------	-------	-------	-------	-------	2.0	25	40
Dagor silt loam, 4 to 8 percent slopes	-------	-------	-------	-------	-------	-------	2.0	40	45
Dagor silt loam, 10 to 20 percent slopes	-------	-------	-------	-------	-------	-------	2.0	15	40
Green Canyon gravelly loam, 0 to 3 percent slopes	4.0	55	50	-------	-------	250	-------	-------	-------
Green Canyon gravelly loam, 3 to 7 percent slopes	3.5	50	45	-------	-------	250	-------	-------	-------
Greenson loam, 0 to 3 percent slopes	5.0	75	90	21	24	300	-------	-------	-------
Greenson loam, 3 to 6 percent slopes	4.5	60	75	-------	-------	275	-------	-------	-------
Greenson loam, 6 to 10 percent slopes	3.5	60	70	-------	-------	275	-------	-------	-------
Greenson loam, deep over gravel, 0 to 1 percent slopes	4.5	75	85	20	22	275	-------	-------	-------
Greenson loam, deep over clay, 0 to 1 percent slopes	5.0	75	90	20	22	275	-------	-------	-------
Hendricks silt loam, 1 to 3 percent slopes	6.0	75	85	22	22	300	2.0	40	35
Hendricks silt loam, 3 to 6 percent slopes	5.5	70	80	-------	-------	300	2.0	40	35
Hendricks silt loam, 6 to 10 percent slopes	5.0	55	75	-------	-------	250	2.0	35	30
Hendricks silt loam, 10 to 20 percent slopes	-------	-------	-------	-------	-------	-------	1.7	35	30
Hiibner gravelly clay loam, 3 to 10 percent slopes	-------	-------	-------	-------	-------	-------	1.5	25	-------
Hyrum gravelly loam, 4 to 8 percent slopes	-------	-------	-------	-------	-------	-------	2.0	35	30
Hyrum gravelly loam, 10 to 25 percent slopes	-------	-------	-------	-------	-------	-------	1.5	30	25
Hyrum cobbly loam, 4 to 8 percent slopes	-------	-------	-------	-------	-------	-------	1.8	30	30
Kidman fine sandy loam, 0 to 2 percent slopes	6.0	80	90	22	20	330	-------	-------	-------
Kidman fine sandy loam, 8 to 15 percent slopes	5.0	60	75	-------	-------	225	-------	-------	-------
Kidman fine sandy loam, deep water table, 0 to 2 percent slopes	6.0	80	90	22	20	300	-------	-------	-------
Kidman fine sandy loam, deep water table, 2 to 4 percent slopes	5.5	80	90	22	20	300	-------	-------	-------
Kidman fine sandy loam, deep water table, 4 to 8 percent slopes	5.0	70	75	-------	-------	250	-------	-------	-------
Kirkham-Shay complex	4.5	60	70	20	18	275	-------	-------	-------
Layton loamy fine sand	5.5	70	90	22	20	300	-------	-------	-------
Lewiston fine sandy loam	5.0	75	85	20	20	275	-------	-------	-------
Lewiston fine sandy loam, strongly alkali	4.0	60	75	-------	-------	250	-------	-------	-------
Logan silty clay loam	4.0	65	75	18	20	-------	-------	-------	-------
McMurdie silt loam, 0 to 3 percent slopes	6.0	75	85	22	22	-------	2.0	45	35
McMurdie silt loam, 3 to 6 percent slopes	5.5	70	80	-------	-------	-------	2.0	40	35
McMurdie silt loam, 6 to 10 percent slopes	5.0	55	75	-------	-------	-------	2.0	35	30
Mendon silt loam, 0 to 3 percent slopes	6.0	65	80	18	-------	-------	2.5	40	45
Mendon silt loam, 3 to 6 percent slopes	5.0	65	80	-------	-------	-------	2.5	40	45
Mendon silt loam, 6 to 10 percent slopes	4.5	60	-------	-------	-------	-------	2.0	35	-------
Millville silt loam, 0 to 2 percent slopes	5.0	75	90	21	24	-------	-------	-------	-------

See footnote at end of table.

TABLE 2.—*Estimated average acre yields of principal crops*—Continued

Mapping units	Irrigated crops						Nonirrigated crops		
	Alfalfa	Wheat	Barley	Sugar beets	Corn for silage	Pasture	Alfalfa	Wheat	Barley
	Tons	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Tons*	*Bu.*	*Bu.*
Millville silt loam, 2 to 4 percent slopes	6. 0	85	90	22	25	--------	--------	--------	--------
Nebeker silt loam, 3 to 6 percent slopes	5. 5	70	80	--------	--------	--------	2. 0	40	35
Nebeker silt loam, 6 to 10 percent slopes	5. 0	55	75	--------	--------	--------	2. 0	35	30
Nebeker silt loam, 10 to 25 percent slopes	--------	--------	--------	--------	--------	--------	1. 8	35	30
Nibley silty clay loam, 0 to 3 percent slopes	5. 0	65	75	20	20	275	--------	--------	--------
Nibley silty clay loam, 3 to 6 percent slopes	4. 5	60	60	20	--------	275	--------	--------	--------
Parleys silt loam, 0 to 3 percent slopes	6. 0	85	90	22	25	300	2. 0	35	35
Parleys silt loam, 3 to 6 percent slopes	5. 0	75	80	20	--------	275	2. 0	30	30
Parleys silt loam, 6 to 10 percent slopes	5. 0	60	75	--------	--------	200	1. 8	25	--------
Parlo silt loam, 0 to 3 percent slopes	6. 0	85	90	22	25	350	1. 5	30	--------
Parlo silt loam, 3 to 6 percent slopes	5. 0	75	--------	--------	--------	--------	1. 5	30	--------
Parlo silt loam, 6 to 10 percent slopes	--------	--------	--------	--------	--------	--------	1. 5	30	--------
Preston fine sand, 0 to 10 percent slopes	3. 0	50	70	--------	--------	200	--------	--------	--------
Provo loam	4. 0	60	70	--------	18	200	--------	--------	--------
Quinney silt loam	4. 5	35	60	16	18	220	--------	--------	--------
Ricks gravelly loam, 0 to 3 percent slopes	4. 5	55	50	--------	--------	250	--------	--------	--------
Ricks gravelly loam, 3 to 6 percent slopes	4. 0	55	50	--------	--------	250	--------	--------	--------
Ricks gravelly loam, 6 to 10 percent slopes	4. 0	--------	--------	--------	--------	225	--------	--------	--------
Roshe Springs silt loam	5. 0	75	90	21	26	300	--------	--------	--------
Salt Lake silty clay loam	4. 5	65	75	15	18	275	--------	--------	--------
Shay silty clay loam	4. 5	60	60	18	19	275	--------	--------	--------
Steed gravelly loam, 0 to 3 percent slopes	3. 5	45	70	--------	--------	225	--------	--------	--------
Steed gravelly loam, 3 to 6 percent slopes	3. 0	40	40	--------	--------	225	--------	--------	--------
Steed gravelly loam, 6 to 10 percent slopes	3. 0	--------	--------	--------	--------	200	--------	--------	--------
Sterling gravelly loam, 6 to 10 percent slopes	3. 0	40	50	--------	--------	225	--------	--------	--------
Sterling gravelly loam, 10 to 20 percent slopes	3. 0	40	45	--------	--------	225	--------	--------	--------
Timpanogos silt loam, 0 to 3 percent slopes	6. 0	85	90	22	25	300	2. 0	35	35
Timpanogos silt loam, 3 to 6 percent slopes	5. 5	75	80	20	--------	275	2. 0	30	35
Timpanogos silt loam, 6 to 10 percent slopes	5. 0	60	75	--------	--------	200	1. 5	25	--------
Timpanogos silt loam, 10 to 20 percent slopes, eroded	--------	--------	--------	--------	--------	--------	1. 5	25	--------
Timpanogos silt loam, deep water table, 0 to 3 percent slopes	5. 0	80	90	22	24	300	--------	--------	--------
Trenton silty clay loam, 0 to 2 percent slopes	5. 0	35	60	16	20	250	1. 0	27	24
Trenton silty clay loam, 2 to 4 percent slopes	5. 0	35	60	--------	20	250	1. 0	27	24
Trenton silty clay loam, 4 to 8 percent slopes	4. 5	35	60	--------	--------	220	1. 0	27	24
Trenton silty clay loam, 8 to 20 percent slopes, eroded	--------	--------	--------	--------	--------	--------	. 8	25	22
Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes	3. 5	30	55	15	18	250	--------	--------	--------
Winn silt loam	4. 0	55	70	16	16	250	--------	--------	--------
Woods Cross silty clay loam	4. 5	70	75	--------	--------	250	--------	--------	--------

[1] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture is grazed during a single season without injury to the sod. An acre of pasture that provides 30 days of grazing for 2 cows has a carrying capacity of 60 cow-acre-days.

the soils, the available water capacity, the hazard of erosion, and the water needed to replace that lost since the last irrigation. In areas where salt and alkali occur, the soils are periodically leached.

Soils that have a texture of loam to clay are plowed in fall, and those with a texture of sandy loam to sand, in spring. They are harrowed and floated once. Borders and corrugations for cover crops are made, and the seeds are drilled.

Only a good quality of clean seeds, mostly certified, are used. Alfalfa is planted from March 15 to April 15, or, in stubble, from August 1 to September 1. Barley is planted from March 15 to April 30 or from September 1 to September 30. Sugar beets are planted from March 15 to April 15.

A suitable rotation to obtain the yields is alfalfa for 3 to 5 years, small grains for 1 to 2 years, row crops for 1 to 2 years, and small grains and alfalfa for 1 year. Alfalfa requires 100 to 120 pounds of phosphate fertilizer per acre when it is seeded and again in the third year. Small grains need 50 to 100 pounds of nitrogen fertilizer per acre or to 20 tons of barnyard manure. None is needed the first year if small grains are planted after alfalfa. Sugar beets need 80 to 100 pounds of nitrogen fertilizer or 15 to 20 tons of barnyard manure and 75 to 100 pounds of phosphate fertilizer.

Weeds are controlled by tilling, spraying, and hoeing. Dodder is removed from alfalfa. Measures to control diseases and insects are adequately applied when needed. Where sugar beets follow sugar beets, the soils are fumigated for nematodes.

Harvesting is done when the crop is at its peak of maturity to obtain highest yields and best quality.

To obtain the yields for nonirrigated crops listed in table 2, the soils are stabilized and erosion is controlled by using such practices as stubble mulching, contour tillage, grassed waterways, and proper disposal of water.

The soils are tilled in spring by noble blade or wheatland plow and by rod weeder twice during summer and once before seeding if weeds are a problem.

Certified cleaned seeds are used. Planting is done from September 1 to September 20 in most years at a rate of 40 to 60 pounds per acre.

Nitrogen fertilizer is applied early in spring at a rate of 20 to 40 pounds per acre in years when precipitation is above average.

Weeds are controlled by spraying as needed. Insects and diseases are controlled by spraying and tillage.

Seeding, tillage, and harvesting are done at the best time to obtain the highest yields.

Use of the Soils for Range[3]

Soils in the Cache Area that are used for range generally are not suited to cultivation, because of soil characteristics, site factors, or climatic limitations. Some of the soils are very gravelly or very cobbly or stony, and the areas are interspersed with areas of rock outcrop. Many of the soils are very steep; some soils are wet or are affected by salts or alkali, and these limitations cannot economically be corrected; and some soils are at high elevations where the climate is too cold or the growing season is too short for cultivated crops. Soils used for range are shallow to very deep and have textures ranging from sand to clay. Some soils are uniform throughout their depth; others have been excessively leached and have formed distinct horizons.

Range is an important resource in the Cache Area. Approximately 310,000 acres, or 60 percent of the survey area, is in native vegetation and is used for range. Perennial grasses, shrubs, and forbs are the main kinds of vegetation, but some areas are under a cover of aspen, maple, and coniferous trees. Woodland areas are used to some extent as range. The acreage of conifers and aspen trees amounts to about 15 percent of the total acreage in the survey area, or about 80,000 acres. Maple is the dominant cover on about 3 percent of the survey area, or about 15,000 acres. The total acreage in range includes about 30,000 acres of wet meadow pastures. These pastures are used principally for range, but some of the grasses are cut for meadow hay.

Range is used primarily for grazing by sheep and cattle in spring, summer, and fall. The soils on the Wellsville Mountains within the Cache National Forest are withheld from grazing and are used only as watershed.

Range Sites and Condition Classes

All of the soils of the survey area that are still in native vegetation and that are used for range have been grouped into range sites. Range sites are distinctive kinds of rangeland with different potentials for producing native plants. Each range site has its own combination of environmental conditions. Distinction between range sites is recognized by differences in kinds and proportions of native plants that compose the potential plant community.

Range condition is the present state of the vegetation in relation to the potential condition for that site. Four condition classes are recognized. Range in *excellent* condition has 76 to 100 percent of the vegetation that is characteristic of the potential vegetation for the same site; that in *good* condition, 51 to 75 percent; that in *fair* condition, 26 to 50 percent; and that in *poor* condition, less than 26 percent. Range condition is determined by comparing present vegetation with the potential.

Plants are grouped according to their response to grazing. *Decreaser* plants are species present in the potential plant community that decrease in relative abundance with continued moderately heavy or heavy grazing use. They are mainly perennials that are palatable to livestock and are generally, although not always, dominant species of the potential plant community.

Increaser plants are species present in the potential plant community that normally increase in abundance as the decreaser plants decline. Some plants that increase at first may later decrease as intensive use is continued. Increaser plants are commonly, although not always, the shorter, less productive members of the potential vegetation. Their forage value ranges from high to low.

Invaders are plants that are not members of the potential plant community for the site. These plants invade, occupy the site, and increase in amount when the decreaser plants are too heavily grazed. The invader plants are not restricted to exotics. They may be normal components of the potential plant community on other range sites in the same locality.

Climatic Zones and Their Effect on Range

Plants growing on the range in different parts of the survey area are affected not only by differences in the kinds of soil but also by differences in climate. Four climatic zones are recognized in the survey area. These zones are determined on the basis of differences in the amount of moisture received, on differences in the average annual temperature, and on the length of the growing season. Zones are the Upland climatic zone; the Mountain climatic zone; the High Mountain climatic zone; and the Wet and Semiwet climatic zone.

UPLAND CLIMATIC ZONE. In this zone the annual precipitation ranges from 14 to 17 inches and falls mostly as snow. Precipitation in summer contributes little to the growth of plants. The period when plants make their greatest amount of growth begins about April 1 and continues until moisture is depleted or until the plants mature, generally about July 1. Some plants show growth late in summer and early in fall if moisture is available. The frost-free season is about 150 days. The mean annual air temperature is 45° to 50° F.

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[3] BENJAMIN B. HEYWOOD, range conservationist, Soil Conservation Service, assisted in the preparation of this section.

Three range sites are in the Upland climate zone. They are the Upland Shallow Loam, the Upland Stony Loam, and the Upland Loam.

MOUNTAIN CLIMATIC ZONE. In this zone the average annual precipitation ranges from 17 to 25 inches and is mostly snow. Precipitation in summer contributes little to plant growth. The growing season is from about April 15 to about July 31 or until moisture is depleted or plants mature. If moisture is available, some plants grow until late in summer or early in fall. Mountain range sites are on all exposures and slopes. The elevations range from 5,000 to 8,000 feet. The mean annual air temperature is 36° to 45° F.

In the Cache Area, six range sites are in the Mountain climatic zone. These are the Mountain Shallow Loam, the Mountain Stony Loam, the Mountain Clay, the Mountain Stony Clay, the Mountain Loam (Shrubs), and the Mountain Loam.

HIGH MOUNTAIN CLIMATIC ZONE. The average annual precipitation ranges from 25 to 35 inches and is mostly as snow. The growing season is from about May 15 to about September 20 or until a killing frost in fall. High Mountain sites are on all exposures and slopes. The elevations range from 7,000 to 9,500 feet. The mean annual air temperature ranges from 35° to 42° F.

Two range sites are in the High Mountain climatic zone. These are the High Mountain Loam (Aspen) and High Mountain Loam (Conifer). They are mostly covered by trees, but some forage is available for grazing.

WET AND SEMIWET ZONE. In this zone the soils are wet because they receive run-in water or have a high water table. In these areas, the climate is characterized by cold, snowy winters and warm, dry summers. The average annual precipitation ranges from 14 to 17 inches. Most of the water available to plants is from run-in water from adjacent irrigated land or from the water table. The growing season is from about April 15 to about September 1 or until frost. The frost-free season is 120 to 130 days. The mean annual air temperature is about 45° F.

Range sites in the Wet and Semiwet zone are Wet Meadow, Semiwet Meadow, and Alkali Bottom.

Descriptions of Range Sites

Fourteen range sites have been recognized in the survey area. These are described in the following pages.

ALKALI BOTTOM RANGE SITE

This site consists of somewhat poorly drained and moderately well drained soils on low lake terraces and on flood plains. Slopes range from 0 to 20 percent. These soils are moderately to strongly affected by salt and alkali. The surface layer is mainly silt loam, but in places it is loam or silty clay loam. Permeability is slow to very slow. Available water capacity to a depth of 5 feet is moderately high. Runoff is slight to ponded, and the hazard of erosion is slight. The depth to the water table is most commonly between 20 and 40 inches. Plants commonly are shallow rooted because of the high concentration of salt and alkali in the subsoil and substratum.

The potential plant community consists of salt- and alkali-tolerant perennial grasses, which are 50 to 60 percent decreaser grasses and 30 to 40 percent increaser grasses; 0 to 1 percent forbs; and 5 to 10 percent shrubs. Common invaders on this site are cheatgrass, povertyweed, snakeweed, big sagebrush, saltcedar, and curlycup gumweed. Plant density is 45 to 50 percent.

Early grazing and heavy grazing have caused saltgrass, foxtail, and other increasers to become prominent on this range site. Fencing into smaller pastures and rotated deferred systems of grazing will improve the vegetation on this site.

The approximate composition of the climax (or potential) plant community for the Alkali Bottom range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Alkali bluegrass	10	Wiregrass	3
Alkali cordgrass	5	Total forbs	1
Alkali sacaton	10	Big rabbitbrush[1]	2
Creeping wildrye	2	Fourwing saltbush	5
Great Basin wildrye	5	Nuttall saltbush	5
Tufted hairgrass	5	Gray molly	2
Other grasses and grasslike plants[1]	5	Greasewood[1]	5
Saltgrass	25	Total	100
Sedges	10		

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,700 to 2,500 pounds of air-dry forage per acre in favorable years and 650 to 1,000 pounds per acre in less favorable years. Approximately 90 percent of this production is from plants that provide forage for livestock and wildlife.

HIGH MOUNTAIN LOAM (ASPEN) RANGE SITE

This site consists of well-drained soils on mountains, fans, and valley bottoms. Slopes are 3 to 70 percent. In most places these soils are gravelly, cobbly, and stony on the surface or in the profile. They are moderately permeable. The available water capacity is moderate to high, and roots penetrate to a depth of 5 feet or more. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. This site is on all exposures. On north- and east-facing slopes, the site is at lower elevations than it is on the south- and west-facing slopes.

The potential plant community is aspen and an understory of 30 to 40 percent decreaser grasses and 10 to 20 percent increaser grasses, 40 to 50 percent forbs, and 5 to 15 percent shrubs. Common invaders are annuals, stinging nettle, tarweed, and big sagebrush. Density of the aspen overstory is 50 to 70 percent.

Range deterioration is shown by the reduction of the better grasses and the increase in western coneflower, shrubs, such as snowberry, and other less palatable plants. Broadcast seeding of orchardgrass or other grasses is possible in some areas. The proper time for these seedings is early in fall. Range improvement is mostly dependent on proper range use and on a rotation-deferred system of grazing.

The woodland value of this site is discussed further in the section "Use of the Soils as Woodland" in this soil survey. The wood products from this site are most useful for excelsior core stock.

The approximate composition of the potential plant community for the High Mountain Loam (Aspen) range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bearded wheatgrass	5	Peavine	4
Blue wildrye	10	Sweet anise	3
Dryland sedge	2	Tall larkspur	1
Mountain brome	20	Western coneflower[1]	1
Nodding bluegrass	3	Other forbs	6
Other grasses	3	Aspen[1]	30
Butterweed	4	Shrubs	3
Cowcabbage	1		
Edible valerian	4	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 4,500 to 5,300 pounds of air-dry forage per acre in favorable years and 1,800 to 3,200 pounds per acre in less favorable years. Approximately 70 percent of this production is from plants that provide forage for livestock and wildlife.

HIGH MOUNTAIN LOAM (CONIFER) RANGE SITE

This site consists of well-drained and somewhat excessively drained soils on mountains. It is mainly on north- and east-facing slopes at lower elevations, but is on south- and west-facing slopes at higher elevations. Slopes are 6 to 70 percent. In most places these soils are gravelly, cobbly, or stony on the surface and in the profile. The permeability is moderate to moderately rapid. The available water capacity is moderate to high. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

The potential plant community is dominantly mixed stands of alpine fir, Douglas-fir, Engelmann spruce, and aspen. Logging, fire, and disease have thinned the tree stands in some areas. Grass and shrubs provide a considerable amount of forage for livestock and wildlife.

The more important decreasers are blue wildrye, mountain brome, and bearded wheatgrass. The more important increasers are pinegrass and Kentucky bluegrass. A common invader is western coneflower.

The woodland value of this site is discussed further in the section "Use of the Soils as Woodland" in this soil survey.

MOUNTAIN CLAY RANGE SITE

This site consists of well-drained soils in the lower areas on fans and mountains and on small valley bottoms. Slopes range from 3 to 30 percent. Generally, these soils have a clay or silty clay texture within a depth of 12 inches. They are slowly permeable. The available water capacity is high. Runoff is slow to medium, and the erosion hazard is slight to moderate. In most areas, swelling and cracking has caused an irregular surface.

The potential plant community is 75 to 85 percent decreaser grasses, 5 to 10 percent increaser grasses, 5 percent forbs, and 5 percent shrubs. The dominant grasses are slender wheatgrass and Idaho fescue. Common invaders are cheatgrass, squirreltail, tarweed, gumweed, and big sagebrush. Plant density is 55 to 65 percent.

Because of its accessibility and the gentle slopes of the soils, this range site has been used heavily by livestock. Excessive and untimely grazing has caused mulesear dock and low sagebrush to increase and become the dominant plants. Many of the better grasses are lacking, or they make up only a small percentage of the present plant cover.

These soils are suitable for plowing and reseeding, but, because the soils are fine textured, timing of operations at the right moisture content is extremely important. This site responds exceptionally well to spraying for the control of broad-leaved plants, big sagebrush, and low sagebrush.

The approximate composition of the potential plant community for the Mountain Clay range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	5	Total forbs[1]	5
Columbia needlegrass	3	Bitterbrush	1
Great Basin wildrye	5	Big sagebrush[1]	1
Idaho fescue	10	Serviceberry	2
Slender wheatgrass	50	Other shrubs[1]	3
Western wheatgrass	5		
Other grasses	10	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,800 to 3,500 pounds of air-dry forage per acre in favorable years and 1,500 to 1,750 pounds per acre in less favorable years. Approximately 90 percent of this production is from plants that provide forage for livestock and wildlife.

MOUNTAIN LOAM RANGE SITE

This site consists of well-drained soils on fans, mountains, and small valley bottoms. Slopes range from 6 to 80 percent. In places these soils have gravel and cobblestones in the lower part of the profile. They are moderately to slowly permeable. The available water capacity is moderately high to high. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

The potential plant community is 75 to 85 percent decreaser grasses, 10 to 20 percent increaser grasses, 3 to 5 percent forbs, and 5 to 10 percent shrubs. Common invaders are cheatgrass, gumweed, and horsebrush.

Early grazing and overgrazing in the past caused an increase in big sagebrush and broadleaved forbs in many areas, and fires caused an increase in yellowbrush and big rabbitbrush. In recent years, however, large areas have been sprayed and the vegetation is in good or excellent condition. Spraying with 2, 4-D is effective in suppressing undesirable shrubs and forbs. Where slopes are 30 percent or less, the soils are suitable for plowing and reseeding.

The approximate composition of the potential plant community for the Mountain Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	61	Big sagebrush[1]	2
Great Basin wildrye	3	Snowberry	1
Other grasses	15	Yellowbrush[1]	1
Tall native bluegrass	6	Other shrubs	2
Total forbs	5		
Bitterbrush	4	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,750 to 2,750 pounds of air-dry forage per acre in favorable years and 1,050 to 1,750 pounds per acre in less favorable years. Approximately 95 percent of this production is from plants that provide forage for livestock and wildlife.

MOUNTAIN LOAM (SHRUBS) RANGE SITE

This site consists of well-drained soils on east- and north-facing slopes of mountains and in small canyons and drainageways. Slopes range from 20 to 70 percent. In places these soils are gravelly and cobbly. They are moderately to slowly permeable. The available water capacity is moderately high to high. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high.

Generally, snowdrifts increase the available moisture. The increase in available moisture has caused such shrubs and trees as ceanothus, maple, and chokecherry to increase in density and give the site a woodland appearance.

The potential plant community consists of 40 to 55 percent decreaser grasses, 15 to 20 percent increaser grasses, 10 to 15 percent forbs, and 15 to 25 percent shrubs. The common invaders are gumweed, houndstongue, and big rabbitbrush. The plant density is 40 to 50 percent.

Heavy grazing and fire have caused an increase in maple and other browse plants. The dense cover of woody plants limits the grazing value of this site. This site is better suited to use by sheep than by cattle. The excellent food and cover on this site are very important to the deer herds.

The use of mechanical equipment in improving the site is not feasible, because of the steep and very steep, rough topography. It is possible to spray some areas with herbicides and retard the browse growth; however, range improvement depends mostly on proper range use and or rotation and deferred grazing.

The approximate composition of the potential plant community for the Mountain Loam (Shrubs) range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bearded wheatgrass	3	Other forbs [1]	9
Bluebunch wheatgrass	33	Big sagebrush [1]	2
Great Basin wildrye	8	Bitterbrush	2
Western wheatgrass	3	Maple [1]	20
Other grasses	10	Other shrubs	5
Balsamroot	2	Total	100
Little sunflower	3		

[1] These plants show little or no use by livestock.

This range site has an estimated total production of 2,400 to 3,000 pounds of air-dry forage per acre in favorable years and 1,500 to 2,000 pounds per acre in less favorable years. Approximately 70 percent of this production is from plants that provide forage for livestock and wildlife.

MOUNTAIN SHALLOW LOAM RANGE SITE

This site consists of somewhat excessively drained, stony and cobbly soils. These soils are most commonly on south- and west-facing slopes and on ridgetops. Slopes range from 6 to 70 percent. The permeability is moderately rapid to moderate. The available water capacity is low. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. Snow often blows off of this site. Effective moisture for plant growth is generally depleted by about July 1.

The potential plant community consists of 30 to 45 percent decreaser grasses, 5 to 20 percent increaser grasses, 3 to 15 percent forbs, and 40 to 50 percent shrubs. Common invaders are thistle, tarweed, mulesear dock, cheatgrass, yellowbrush, and juniper. Plant density is 30 to 35 percent.

This range site is used extensively by deer in winter and spring. Overuse in the past has caused an increase in curlleaf mountain-mahogany, serviceberry, and other undesirable shrubs and a decrease in the better grasses and desirable browse and forbs. Range improvement practices are restricted to proper range use and rotation-deferred grazing because of the rough, steep topography and shallow soils.

The approximate composition of the potential plant community for Mountain Shallow Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	20	Bitterbrush	15
Great Basin wildrye	10	Big sagebrush [1]	8
Indian ricegrass	2	Oakbrush [1]	3
Tall native bluegrass	3	Serviceberry	3
Other grasses	8	Yellowbrush [1]	3
Balsamroot	5	Other shrubs [1]	5
Other forbs [1]	10	Total	100
Birchleaf mountain-mahogany	5		

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,250 to 1,750 pounds of air-dry forage per acre in favorable years and 550 to 1,000 pounds per acre in less favorable years. Approximately 80 percent of this production is from plants that provide forage for livestock and wildlife.

MOUNTAIN STONY CLAY RANGE SITE

This site consists of well-drained soils (fig. 16) on fans and foot slopes of mountains. Slopes are 1 to 30 percent. Stones and cobblestones, ranging from 3 inches to 3 feet in diameter, are on the surface and throughout the profile. The available water capacity is moderate. The permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

The potential plant community is about 70 percent decreaser grasses, 10 percent increaser grasses, 10 percent forbs, and 10 percent shrubs. Common invaders are big sagebrush, big rabbitbrush, tarweed, gumweed, and cheatgrass. Plant density is 50 to 60 percent.

Early grazing and heavy grazing have caused an increase in low sagebrush and mulesear dock. Now these plants generally are dominant on the site.

Range seeding is not feasible, because of the stony, fine-textured soils. However, the vigor and density of desirable grasses can be improved by spraying the broad-leaved plants and low sagebrush. This site is well suited to aerial spraying, and results are excellent. Rotation-deferred grazing and proper range use are necessary on this site.

The approximate composition of the potential plant community for Mountain Stony Clay range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	15	Mulesear dock [1]	4
Great Basin wildrye	25	Other forbs	6
Slender wheatgrass	35	Bitterbrush	5
Tall native bluegrass	4	Other shrubs [1]	3
Other grasses	3	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 3,000 to 3,300 of air-dry forage per acre in favorable years and 1,000 to 1,700 pounds per acre in less favorable years. Approximately 95 percent of this production is from plants that provide forage for livestock and wildlife.

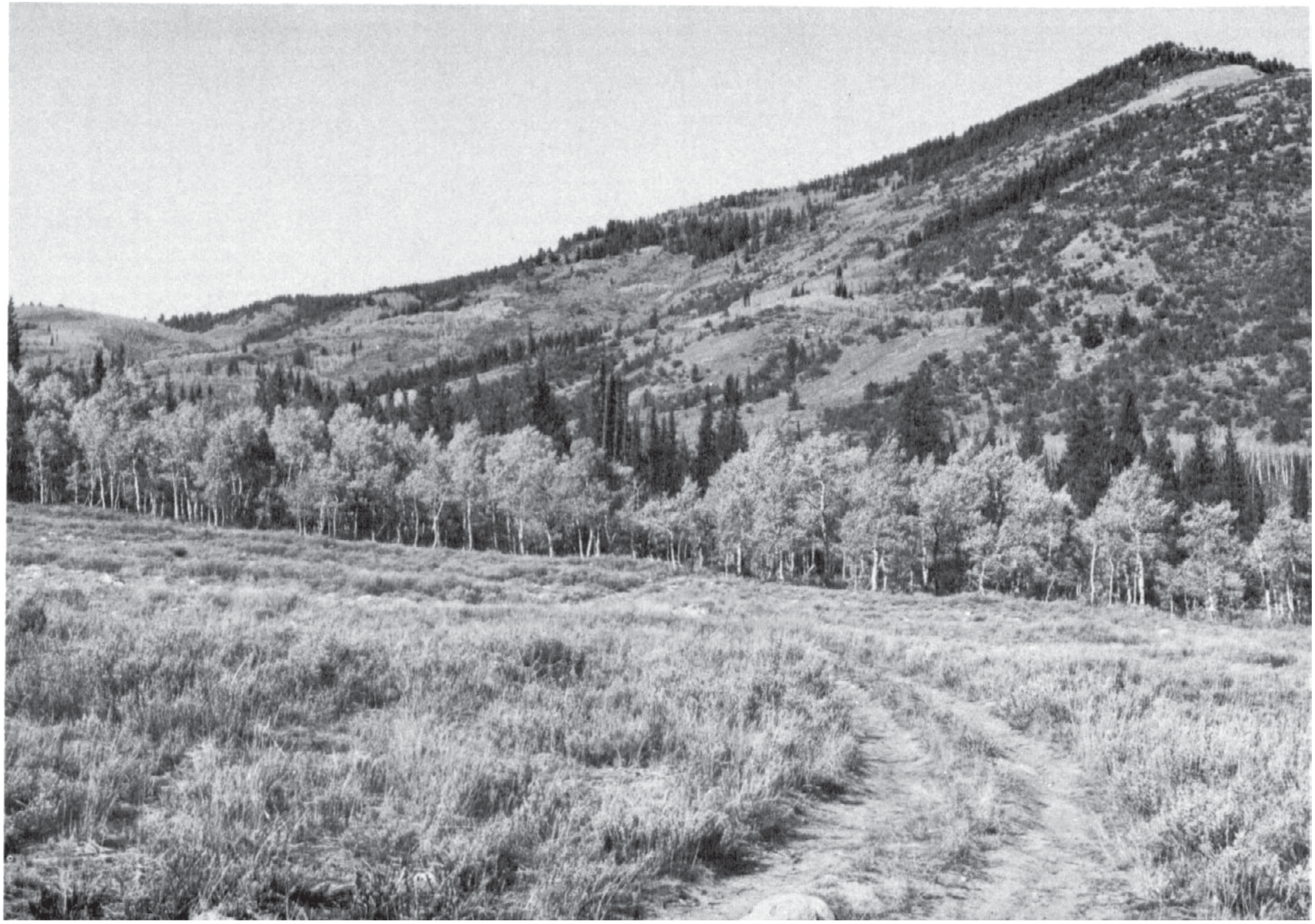

Figure 16.—**An area used for range. Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded, in Mountain Stony Clay range site, is in the foreground. An area of High Mountain (Aspen) range site is in the upper left-hand side of the picture, and an area of Mountain Shallow Loam range site is in the upper right-hand corner.**

MOUNTAIN STONY LOAM RANGE SITE

This site consists of well-drained and somewhat excessively drained soils on mountains, fans, and ridges. These soils are on all exposures but most commonly have south- and west-facing slopes. Slopes are 1 to 70 percent. Most of these soils have gravel, cobblestones, or stones on the surface. The available water capacity is moderately low to moderate. The permeability is moderately rapid to slow. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

The potential plant community is 50 to 60 percent decreaser grasses, 10 to 15 percent increaser grasses, 2 to 10 percent forbs, and 25 to 35 percent shrubs. Common invaders are cheatgrass, thistle, gumweed, prickly lettuce, and houndstongue. Plant density is 35 to 50 percent. Big sagebrush, bitterbrush, snowberry, serviceberry, and yellowbrush are dominant in most areas of this site and cause a shrubby aspect.

Early and heavy grazing by livestock and wildlife has caused an increase in the undesirable shrubs and a decrease in the better grasses, forbs, and shrubs.

The soils are generally too steep or too stony for any mechanical reseeding or brush control. Spraying of brush with 2, 4-D by aircraft is feasible. Proper range use and rotation-deferred grazing are needed on this site.

The approximate composition of the potential plant community for Mountain Stony Loam range site is:

Species	*Percentage by weight*
Bluebunch wheatgrass	40
Great Basin wildrye	5
Other grasses	10
Desirable forbs	5
Undesirable forbs[1]	5
Birchleaf mountain-mahogany	3
Bitterbrush	10
Big sagebrush[1]	10
Oakbrush[1]	10
Other shrubs	2
Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,750 to 2,500 pounds of air-dry forage per acre in favorable years and 750 to 1,000 pounds per acre in less favorable years. Approximately 75 percent of this production is from plants that provide forage for livestock and wildlife.

SEMIWET MEADOW RANGE SITE

This site consists of somewhat poorly drained soils on low lake terraces, fans, and flood plains. Slopes are 0 to 10 percent. The water table is most commonly at a depth between 30 and 40 inches.

The potential plant community is 55 to 75 percent decreaser grasses, 15 to 20 percent increaser grasses, 5 to 10 percent forbs, and 0 to 5 percent shrubs. Common invaders are big rabbitbrush, cheatgrass, curlycup gumweed, dandelion, foxtail, greasewood, and Russian-thistle. Plant density is 70 to 80 percent.

This site is managed and grazed together with the Wet Meadow and Alkali Bottom range sites. Because it is somewhat dryer than the other sites, it is overgrazed before the stock use the wetter areas.

Fencing into smaller pastures and establishing a system of rotation and deferred grazing are needed to increase the production and improve the vegetation.

The approximate composition of the potential plant community for the Semiwet Meadow range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Alkali sacaton	5	Peavine	2
Great Basin wildrye	8	Yarrow [1]	2
Idaho fescue	5	Other forbs [1]	4
Sedges	5	Rose	1
Slender wheatgrass	25	Shrubby cinquefoil [1]	1
Tall native bluegrass	5	Silver sagebrush [1]	1
Tufted hairgrass	10	Willows [1]	1
Western wheatgrass	5	Yellowbrush [1]	1
Other grasses and grass-like plants	17	Total	100
Geranium	2		

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,750 to 4,200 pounds of air-dry forage per acre in favorable years and 1,000 to 1,700 pounds per acre in less favorable years. Approximately 90 percent of this production is from plants that provide forage for livestock and wildlife.

UPLAND LOAM RANGE SITE

This site consists of somewhat excessively or well-drained, very gravelly, cobbly, or stony soils. These soils are dominantly on south- and west-facing fans, high lake terraces, and foothills at elevations of 4,600 to 5,700 feet. Slopes are 0 to 50 percent. The available water capacity is moderately low. Permeability is moderate to moderately rapid. Runoff is slow to rapid, and the hazard of erosion is slight to high.

The potential plant community is 60 to 75 percent decreaser grasses, 5 to 10 percent increaser grasses, 5 to 10 percent forbs, and 10 to 20 percent shrubs. Common invaders are cheatgrass, penstemon, Russian-thistle, sunflower, gumweed, juniper, phlox, and snakeweed.

Overgrazing and early grazing have caused a decrease in the better grasses and an increase in big sagebrush, cheatgrass, and annual weeds. An improvement in range condition depends largely on a rotation-deferred system of grazing and on proper range use. The soils are mostly too stony or too steep for reseeding. Spraying with 2, 4-D to control undesirable weeds and big sagebrush is feasible in some areas.

The approximate composition of the potential plant community for the Upland Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	43	Astex [1]	1
Great Basin wildrye	5	Astragalus [1]	1
Indian ricegrass	10	Balsamroot	1
Prairie junegrass	2	Drummond thistle [1]	1
Sandberg bluegrass	5	Lupine [1]	1
Tall native bluegrass	2	Peavine	2
Western wheatgrass	5	Other forbs [1]	3
Other grasses	3	Big sagebrush [1]	4
Bitterbrush	2	Mormon-tea	1
Rubber rabbitbrush [1]	1	Yellowbrush [1]	2
Other shrubs [1]	5	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,300 to 2,500 pounds of air-dry forage per acre in favorable years and 550 to 1,300 pounds per acre in less favorable years. Approximately 85 percent of this production is from plants that provide forage for livestock and wildlife.

UPLAND SHALLOW LOAM RANGE SITE

This site consists of somewhat excessively drained, stony and cobbly soils on south- and west-facing high lake terraces and foothills. Slopes range from 10 to 70 percent. The low available water capacity limits the moisture available for plant growth. Permeability is moderate. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

The potential plant community is 50 to 65 percent decreaser grasses, 5 to 10 percent increaser grasses, 5 to 10 percent forbs, and 15 to 20 percent shrubs. Common invaders are cheatgrass, thistle, gumweed, and snakeweed. Plant density is 35 to 45 percent.

Generally, the range condition of this site is improving. Although former heavy use in spring caused an increase in big sagebrush and yellowbrush and a decrease in bluebunch wheatgrass, young plants of bluebunch wheatgrass and prairie junegrass now are numerous. Spraying the undesirable shrubs and forbs with 2, 4-D increases the production of grasses.

The soils generally are too stony, too steep, and too shallow for reseeding. The better grasses can be increased in vigor and amount by deferring grazing until after seed maturity.

The approximate composition of the potential plant community for the Upland Shallow Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	50	Big sagebrush [1]	10
Sandberg bluegrass	6	Bitterbrush	5
Other grasses	4	Low sagebrush [1]	10
Balsamroot	3	Phlox [1]	3
Phlox	2	Yellowbrush [1]	2
Other forbs	5	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,750 to 2,500 pounds of air-dry forage per acre in favorable years and 700 to 1,500 pounds per acre in less favorable years. Approximately 75 percent of this production is from plants that provide forage for livestock and wildlife.

UPLAND STONY LOAM RANGE SITE

This site consists of well-drained soils on fans, terraces, and foothills at elevations of 4,400 to 6,000 feet. Slopes are 4 to 50 percent. In places the soils are gravelly or cobbly. The available water capacity is moderately high or high. Permeability is moderate to moderately slow. Runoff is slow to rapid, and the hazard of erosion is slight to high.

The potential plant community is 60 to 70 percent grass, 2 to 5 percent forbs, and 20 to 30 percent shrubs. Common invaders are cheatgrass, Russian-thistle, gumweed, big rabbitbrush, and snakeweed. Plant density is 40 to 50 percent.

Heavy grazing or early grazing has caused a decrease in production in some areas. Big sagebrush, cheatgrass, and weeds are dominant in the plant community in some low-producing areas.

The soils in this site are well suited to range improvement practices, spraying with 2, 4-D to control bushes and weeds, and proper range use. Slopes up to 30 percent can be reseeded.

The approximate composition of the potential plant community for the Upland Stony Loam range site is:

Species	*Percentage by weight*
Bluebunch wheatgrass	62
Indian ricegrass	3
Other grasses	5
Balsamroot	2
Phlox [1]	1
Other forbs [1]	2
Big sagebrush [1]	5
Birchleaf mountain-mahogany	2
Bitterbrush	3
Black sagebrush	10
Shadscole [1]	5
Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,400 to 2,300 pounds of air-dry forage per acre in favorable years and 750 to 1,400 pounds per acre in less favorable years. Approximately 85 percent of this production is from plants that provide forage for livestock and wildlife.

WET MEADOW RANGE SITE

This site consists of poorly drained soils on flood plains and low lake terraces and in drainageways. Slopes range from 0 to 3 percent. The surface layer is black or nearly black. In places these soils are gravelly and cobbly. The water table generally is within a depth of 20 inches.

The potential plant community is 45 to 55 percent decreaser grasses or grasslike plants, 30 to 40 percent increaser grasses or grasslike plants, 3 to 6 percent forbs, and about 2 percent shrubs. Common invaders on this site are annual weeds, big rabbitbrush, cheatgrass, foxtail, cocklebur, povertyweed, curlycup gumweed, and teasel. Plant density is 85 to 100 percent.

The condition of this range site is considerably lower than its potential. Early and prolonged grazing has resulted in a decrease of the better plants and an increase of foxtail barley and saltgrass. A system of rotation grazing and fencing into smaller pastures is needed. Fertilizer, especially nitrogen, should increase production. Better water control also is needed.

The approximate composition of the potential plant community for the Wet Meadow range site is:

Species	*Percentage by weight*
Sedges	40
Tufted hairgrass	24
Wiregrass	10
Other grasses and grasslike plants	20
Shrubs [1]	1
Cinquefoil [1]	1
Native clover [1]	1
Other forbs [1]	2
Willows [1]	1
Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 4,000 to 6,500 pounds of air-dry forage per acre in favorable years and 3,000 to 3,500 pounds per acre in less favorable years. Approximately 95 percent of this production is from plants that provide forage for livestock and wildlife.

Use of the Soils as Woodland[4]

Wood products are harvested from only a comparatively small acreage in the survey area. The trees that are usable for wood products are mainly Douglas-fir, alpine fir, and aspen. About 15 percent of the survey area, or 80,000 acres, has a cover of aspen or conifers. This acreage is divided about evenly, 50 percent each of aspen and conifers. The soils in woodland are generally too step for cultivated crops, or they occur at high elevations where the climate is too cold for cultivated crops.

Woodland Management and Woodland Suitability Groups

Soil properties have a strong influence on species adaptation, tree growth, and woodland management. Differences in texture and depth of the soil material affect the available water capacity and therefore influence tree growth. Slope and aspect also account for differences in the growth of trees and the way woodland is managed.

As a rule, trees grow fastest and tallest on the better soils. Tree growth is about the same on soils that have similar properties, and for this reason it is possible to group soils for woodland management. A group consists of soils that have comparable potential productivity and limitations, that produce similar crops of wood, and that require similar management. Such a group is called a woodland suitability group of soils.

Potential productivity refers to the capability of the soil to produce wood. The best indicator of soil productivity is the height to which the tallest trees will grow in a stated number of years. This height in feet at a given age is called site index. A grouping of site indexes is called site class. For Douglas-fir, site index is based on the average height of the dominant and condominant trees at the age of 100 years. Potential annual growth for this species was adapted from USDA Technical Bulletin 630(*5*). For aspen, site index is based on the average height of the tallest trees at the age of 80 years. Potential annual growth for this species was obtained from USDA Bulletin 1291(*2*). Trees were measured in study plots in the Cache Area and other places in Utah to obtain data for correlation with published growth tables.

The "Guide to Mapping Units" at the back of this survey shows the woodland suitability group for each mapping unit used as woodland in the Cache Area. Woodland suitability groups are identified by 3-digit symbols, consisting of Arabic numerals and lowercase letters that have meanings as follows:

> *First digit* is a numeral that refers to site class. In the Cache Area, site indexes for Douglas-fir in the range of 84 to 71 are in site class 4 (moderate growth potential); those for aspen in the range

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[4] BENJAMIN B. HEYWOOD, range conservationist, Soil Conservation Service, assisted in the preparation of this section.

of 77 and 68 are in site class 2 (high growth potential).

Second digit is a lowercase letter that refers to a soil characteristic that limits woodland use or management. Letters have the following meaning: c, clayey soils; d, restricted rooting depth; f, gravelly soil; r, slopes; s, sandy soil; w, wet soil; x, stony and rocky soil; and o, no soil limitations.

Third digit is a numeral that indicates the degree of hazard and the kinds of trees to which the soils are suited, as follows: Numerals 1, 2, and 3 show that the soils are suited to needleleaf trees. If the numeral is 1, the soils have no particular limitations; 2, means that the soils have one or more moderate limitations; and 3 means that the soils have one or more severe limitations.

The text that follows describes the five woodland suitability groups of soils in the Cache Area. Numbering of woodland suitability groups is based on a statewide system, and not all groups are represented in the Cache Area. Therefore, numbering is not consecutive. Terms used are defined in the following paragraphs.

Seedling mortality refers to the expected soil-caused mortality for naturally occurring or planted seedlings as follows: *Slight* means that the expected mortality is 0 to 25 percent; *moderate* means that the expected mortality is between 25 and 50 percent; and *severe* means that the expected mortality is greater than 50 percent.

Plant competition refers to the invasion or growth of undesirable plants as follows: *Slight* means that competition will not prevent adequate natural regeneration and early growth nor will it interfere with adequate development of planted seedlings. *Moderate* means that competition will delay natural or artificial regeneration. It will affect both establishment and growth rate of trees, but it will not prevent the eventual development of a fully stocked, normal stand. *Severe* means that competition will prevent adequate natural or artificial regeneration without intensive site preparation and weeding.

Erosion hazard refers to the potential of soil erosion that can occur after timber is cut, as follows: *Slight* means that problems of erosion control are unimportant; *moderate* means that some attention must be given to control unnecessary soil erosion; and *severe* means that intensive treatments, specialized equipment, and methods of operation must be planned to minimize soil deterioration.

Windthrow hazard is an evaluation of soil characteristics that affect windfirmness as follows: *Slight* means that normally no trees are blown down by wind. *Moderate* means that some trees are expected to blow down during periods of excessive soil wetness and high wind. *Severe* means that many trees are expected to blow down in areas of wet soil during periods of moderate or high wind.

Equipment limitations refer to restrictions in the use of woodland equipment because of soil-related conditions, as follows: *Slight* means that use of equipment is not restricted in kind or time of year. *Moderate* means that use of equipment is moderately restricted in kind of operations by one or more of such factors as slope, stones, obstructions, seasonal soil wetness, physical soil characteristics, injury to tree roots, soil structure, and soil stability. *Severe* means that special equipment is needed and its use is severely restricted by one or more of the items listed for "moderate," and by safety in operation.

WOODLAND SUITABILITY GROUP 2o1

The soils in this group are well drained. Most of them are gravelly, cobbly, or stony on the surface, in the profile, or both. Slopes range from 6 to 30 percent. These soils are on mountains, fans, and small valley bottoms. Available water capacity is moderate to high. Permeability is moderate to slow. Average annual precipitation is 22 to 30 inches and is mostly snow. The soils in this group are in the Flygare, Lucky Star, Mult, Red Spur, and Scave series.

These soils are highly productive of aspen (fig. 17), and the site index for this tree ranges from 70 to 77. Potential annual growth per acre is 41 cubic feet per acre.

For this group of soils, seedling mortality and the windthrow hazard are slight. Plant competition is moderate. Equipment limitations are moderate. The hazard of erosion is slight.

WOODLAND SUITABILITY GROUP 2r1

The soils in this group are well drained. Most of them are gravelly, cobbly, or stony on the surface, in the profile, or both. Slopes range from 30 to 60 percent. These soils are on mountains and fans. The available water capacity is moderate to high. Permeability is moderate to slow. Average annual precipitation is 22 to 30 inches and is mostly snow. The soils in this group are in the Lucky Star and Mult series.

These soils are steep, but they are highly productive of aspen, and the site index for this tree ranges from 75 to 76. Potential annual growth per acre is 40 to 41 cubic feet.

For this group of soils, seedling mortality and windthrow hazard are slight. Plant competition is moderate. Equipment can be used with moderate limitations. The hazard of erosion is moderate.

WOODLAND SUITABILITY GROUP 4o1

The soils in this group are well drained to somewhat excessively drained. They are mostly gravelly, cobbly, or stony. Slopes range from 6 to 40 percent. These soils are on high mountains, and they mainly have slopes that face north and east. Available water capacity is moderate to high. Permeability is moderately rapid to moderate. Average annual precipitation is 25 to 35 inches and is mostly snow. The soils in the group are in the Cluff, Elwood, and Scout series.

These soils are moderately productive of alpine fir and Douglas-fir. The site index is 76 for alpine fir and ranges from 74 to 81 for Douglas-fir. Potential annual growth per acre is 170 feet.

For this group of soils, seedling mortality and the windthrow hazard are slight. Plant competition is moderate. Equipment limitations are slight. The hazard of erosion is slight.

WOODLAND SUITABILITY GROUP 4r1

The soils in this group are well drained to somewhat excessively drained. They are mostly gravelly, cobbly, or stony. Slopes range from 30 to 80 percent. These soils are on high mountains, and they mainly have slopes that

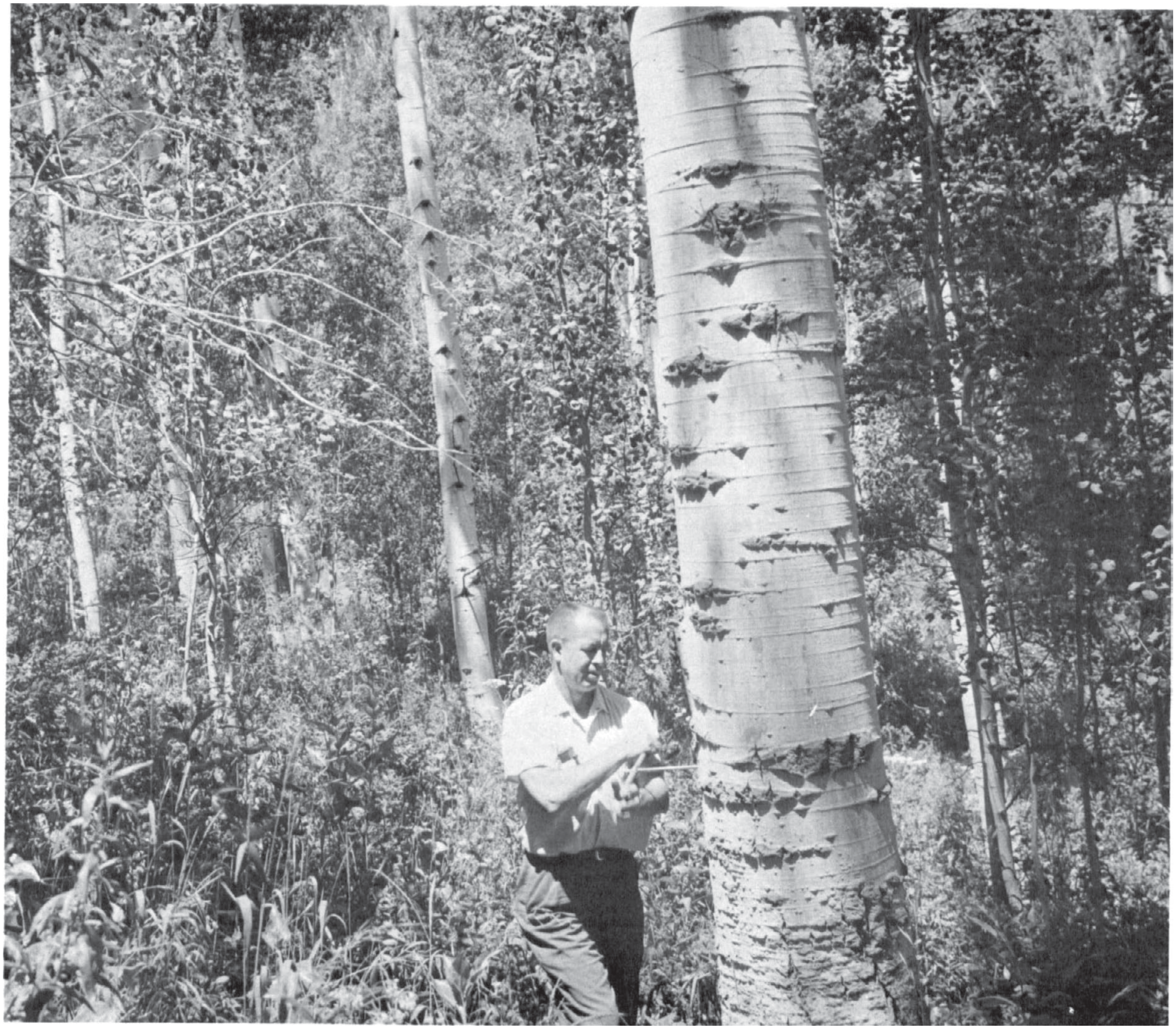

***Figure 17.*—Aspen growing on Lucky Star silt loam, 6 to 30 percent slopes, which is in woodland group 2o1. On this soil the production potential for aspen is high.**

face north and east. Available water capacity is moderate to high. Permeability is moderately rapid to moderate. Average annual precipitation is 25 to 35 inches and is mostly snow. The soils in this group are in the Bickmore, Dateman, Elwood, and Scout series.

These soils are steep, but they are moderately productive of alpine fir and Douglas-fir. Site indexes for these species range from 76 to 82. Potential annual growth per acre ranges from 138 to 171 board feet.

For this group of soils, seedling mortality and the windthrow hazard are slight. Plant competition is moderate. Equipment limitations are moderate. The hazard of erosion is moderate to severe.

WOODLAND SUITABILITY GROUP 4x1

The soils in this group are well drained to somewhat excessively well drained. They are extremely stony or rocky. Slopes are 10 to 80 percent. These soils are on high mountains, and they mainly have slopes that face north and east. Permeability is moderate. Average annual precipitation is 25 to 35 inches and is mostly snow. The soils in this group are in the Dateman and Fitzgerald series.

These soils are moderately productive of alpine fir and Douglas-fir. Site index for these species range from 70 to 81. Potential annual growth per acre ranges from 130 to 144 board feet per acre.

For this group of soils, seedling mortality and windthrow hazard are moderate. Plant competition is moderate. Equipment limitations are severe. The hazard of erosion is slight to severe.

Use of the Soils for Wildlife[5]

Most soils in the Cache Area support vegetation that is used by wildlife to some extent. Most species of wildlife are not confined to areas of a particular soil or group of soils. The presence of wildlife in a given area is dependent upon the availability of food, water, and cover. The suitability of the soil for providing these elements and how the soil is used determine the relative abundance of wild birds and animals.

Natural streams in the survey area provide fishing for local residents and tourists. Some streams are fished the year around. Rainbow, brown, brook, and cutthroat trout reproduce in streams, and the supply is supplemented by stocking. Catfish, carp, suckers, and whitefish are other important species in the local waters. Some fish ponds are privately owned, and there are several commercial fisheries. Most of these are stocked with rainbow trout.

Such small furbearing animals as muskrat, mink, and beaver are trapped in some waters of the Cache Valley and in upland streams. Raising mink is an important source of income.

In this section the wildlife habitat in the Cache Area is discussed in reference to the climatic zones, which are about the same general areas as described for the range sites. The soils are generally placed in four wildlife suitability groups as follows:

WILDLIFE SUITABILITY GROUP 1

This group consists of soils in the Wet and Semiwet climatic zone. These soils receive run-in moisture in addition to precipitation. They are generally deep and somewhat poorly drained or poorly drained. They are moderately coarse textured to fine textured. These soils are nearly level or gently sloping and are on flood plains, fans, or low terraces. The water table generally is within a depth of 40 inches. Some of the soils are ponded, and some are affected by salt and alkali. The soils are in the Airport, Cache, Cardon, Center Creek, Collett, Greenson, Jordan, Kirkham, Lasil, Lewiston, Logan, Nibley, Payson, Provo, Quinney, Roshe Springs, Shay, Salt Lake, Trenton, Winn, and Woods Cross series and Mixed alluvial land.

These soils are near or adjacent to open water in reservoirs, along streams, and around ponds. The vegetation growing on these soils provides food, cover, and escape for wildlife. The vegetation is mainly saltgrass, foxtail, wiregrass, Kentucky bluegrass, native clover, White Dutch clover, four-wing saltbush, teasel, cattails, bulrushes, sedges, alkali sacaton, sagebrush, and willow. Some areas of these soils are cultivated. Diversity of vegetation produces borders that provide food and cover for wildlife.

Ducks, geese, ring-necked pheasant, mourning doves, muskrats, beavers, mink, nongame birds, and small rodents inhabit areas of these soils.

WILDLIFE SUITABILITY GROUP 2

This group consists of soils in the Upland climatic zone. These soils receive 14 to 17 inches of precipitation annually, and temperatures are moderate. The soils range from shallow to deep and are somewhat excessively drained to moderately well drained. They are coarse textured to fine textured. Some of the soils are gravelly, cobbly, and stony. These soils are mostly on intermediate and high lake terraces and deltas of old Lake Bonneville, and on fans. Slopes are 0 to 30 percent. The soils are in the Battle Creek, Blackrock, Collinston, Crookston, Crowshaw, Green Canyon, Hillfield, Hyrum, Kidman, Lakewin, Layton, Leatham, Lewiston, Mendon, Middle, Millville, Munk, Parleys, Parlo, Preston, Richmond, Ricks, Steed, Sterling, Timpanogos, and Wheelon series and Rough broken land and Stony alluvial land.

The vegetation is mainly grasses, but there are scattered shrubs and forbs. The composition is bluebunch wheatgrass, Indian ricegrass, slender wheatgrass, tall native bluegrass, prairie junegrass, Great Basin wildrye, dandelion, cheatgrass, aster, balsamroot, mulesear dock, sunflower, geranium, buckwheat, bitterbrush, big sagebrush, yellowbrush, serviceberry, and snowberry. Most areas of the soils are cultivated and are used for alfalfa, small grain, corn, sugar beets, and orchards. Diversity in vegetation provides borders that are important to wildlife.

Some areas of these soils provide winter range for deer and elk. They also provide habitat for chukar, gray partridge, mourning doves, sage grouse, sharp-tailed grouse, quail, cottontail rabbits, jackrabbits, skunks, and some predators.

WILDLIFE SUITABILITY GROUP 3

This group consists of soils in the Mountain climatic zone. These soils receive 17 to 25 inches of precipitation annually. Winters are cold and snowy. The soils range from shallow to deep and are somewhat excessively drained to well drained. They generally are medium textured to fine textured. Some of the soils are gravelly, cobbly, and stony. These soils are nearly level to very steep, and they occupy rough, mountainous areas and fans. The soils are in the Agassiz, Ant Flat, Avon, Bradshaw, Barfuss, Clegg, Collinston, Curtis Creek, Dagor, Datwyler, Despain, Elzinga, Foxol, Goring, Hendricks, Hiibner, Hoskin, LaPlatta, Lucky Star, Maughan, McMurdie, Mendon, Nebeker, Obray, Picayune, Poleline, St. Marys, Sheep Creek, Smarts, and Yeates Hollow series.

The vegetation is grasses, shrubs, forbs, and some trees. Some of the dominant plants are slender wheatgrass, bluebunch wheatgrass, tall native bluegrass, prairie junegrass, Kentucky bluegrass, Great Basin wildrye, Idaho fescue, cheatgrass, balsamroot, mulesear dock, western coneflower, geranium, cinquefoil, aster, bitterbrush, big sagebrush, yellowbrush, Oregongrape, black sage, cliffrose, snowberry, serviceberry, mountain-mahogany, ceanothus, chokecherry, and maple. Some areas of the soils are cultivated and are used for alfalfa and small grain. These crops provide food and cover for wildlife.

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[5] CLYDE A. SCOTT, biologist, and BENJAMIN B. HEYWOOD, range conservationist, Soil Conservation Service, assisted in the preparation of this section.

Some areas of these soils are important as range for deer and elk in spring and fall. Game birds in these areas are ruffed grouse, blue grouse, sage grouse, pheasant, and chukar. Coyotes, bobcats, weasels, and badgers also are found in these areas.

WILDLIFE SUITABILITY GROUP 4

This group consists of soils in the High Mountain climatic zone. These soils receive 25 to 35 inches of precipitation annually. Temperatures are cold. The soils are shallow to deep, are well drained, and generally are medium textured to fine textured. Most of the soils are gravelly, cobbly, or stony. These soils are sloping to very steep, and they occupy mountainous areas. The soils are in the Bickmore, Cluff, Dateman, Elwood, Fitzgerald, Flygare, Mult, Lucky Star, Scave, Scout, and Red Spur series.

The vegetation is mostly aspen, Douglas-fir, and alpine fir and an understory of grasses, forbs, and shrubs. The main understory plants are wheatgrass, Kentucky bluegrass, geranium, snowberry, elderberry, currants, and chokecherry.

Areas of these soils are the summer range for deer and elk and a few moose or bear. Cougar, bobcat, coyote, mink, blue grouse, ruffed grouse, weasels, and beavers also live in these areas.

Kinds of Wildlife and Their Habitat

Kind of wildlife in the Cache Area and the food, cover, and water resources that support them are discussed in the following paragraphs.

Chukar.—This game bird was introduced from southern Asia. Choice food plants are barley, bristlegrass, cheatgrass, clover, corn, currant, dandelion, oats, pigweed, Indian ricegrass, serviceberry, sunflowers, teasel, timothy, and wheat. Fairly desirable food plants are alfalfa, barnyardgrass, Kentucky bluegrass, chokecherry, and rose. Chukar also eat many insects. Its cover needs are met largely by rocky slopes and steep grasslands.

Mourning dove.—This migratory game bird eats only seeds. It does not eat forage, fruit, or insects. Choice food plants are barnyardgrass, bristlegrass, corn, pigweed, Indian ricegrass, sunflower, and wheat. Fairly desirable plant foods are barley and oats. Maple and orchard trees are favorite nesting sites for doves. They also nest in other trees and on the ground in well-drained sites. Doves must have drinking water daily.

Ducks.—The surface-feeding mallard, pintail, and widgeon live on field grains and aquatic food. Foods in summer include some insects. Foods in winter are chiefly plant seeds and green forage. The choice food plants are barley, barnyardgrass, bulrush, corn, and wheat. Fairly desirable foods are clover, dandelion, peas, and oats. Ducks are attracted most readily to seeds that are covered with shallow water. Nesting occurs near streams, marshes, lakes, and ponds.

Geese.—Foods favored by geese include green forage plants, such as alfalfa, barley, Kentucky bluegrass, clovers, dandelion, rye, timothy, and wheat. The seeds of alfalfa, barley, barnyardgrass, corn, rye, and wheat also are choice foods. Fairly desirable foods are bulrush, cheatgrass, oats, and pigweed.

Gray partridge.—This European game bird was introduced in the Cache Area about 1930. Its habitat is close to grain fields and rangelands. Choice plant foods are barley, barnyardgrass, bristlegrass, teasel, and wheat. Fairly desirable plant foods are alfalfa, cheatgrass, corn, dandelion, oats, pigweed, Indian ricegrass, rose, sunflower, and timothy. Gray partridge also eat insects. Vegetation for nesting and cover is alfalfa, the grassy plants in fencerows, and the plants in weed patches.

Ring-necked pheasant.—This game bird, a native of China, was successfully introduced in the Cache Area in the early 1900's. Its favorite habitat is diversified croplands that have adjacent cover such as cattails, shrubs, or trees along fencerows and streams and other water courses. Choice plant foods are the seeds of barley, barnyardgrass, bristlegrass, corn, oats, pigweed, Indian ricegrass, teasel, and wheat. Fairly desirable foods are alfalfa, Kentucky bluegrass, chokecherry, clovers, currants, dandelion, raspberry, rose, serviceberry, and sunflowers. Pheasants also eat grasshoppers and other insects.

Quail.—This native game bird's choice foods are chiefly seeds. Green forage and seeds from barley, barnyardgrass, Kentucky bluegrass, chokecherry, corn, oats, pigweed, Indian ricegrass, sunflower, teasel, and wheat also are important. Fairly desirable foods are alfalfa, bristlegrass, cheatgrass, clovers, dandelion, rose, and timothy. Quail roost in shrubs and trees and use shrubby thickets for daytime cover.

Nongame birds.—Many kinds of nongame birds live in the survey area. They, like the game birds, thrive best where their choice foods and adequate nesting sites are available. Robins and a few others eat insects, worms, and fruit. Flycatchers, hawks, herons, seagulls, and swallows live almost entirely on fish, frogs, insects, worms, rodents, and snakes. Crows, magpies, and starlings live on other animal foods, fruit, and seed.

Deer and elk.—These big game animals have seasonal variation in their choice of foods. Browse is preferred during summer, fall, and early in winter, but grass makes up much of their diet late in winter and in spring. Elk are more of a grazing animal than are deer.

Engineering Uses of the Soils [6]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Some of those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are slope and depth to the water table and to bedrock. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

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[6] C. E. BIGLER, civil engineer, Soil Conservation Service, helped to prepare this section.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

It should be emphasized that the interpretations made in this survey are not a substitute for the sampling and testing needed at a site chosen for specific engineering work that involves heavy loads or at a site where excavations are deeper than the depths of layers here reported. Also, engineers should not apply specific values to the estimates for bearing capacity given in this survey. Nevertheless, by using this survey, an engineer can select and concentrate on those soils most important for his proposed kind of construction, and in this manner reduce the number of soil samples taken for laboratory testing and complete an adequate soil investigation at minimum cost.

Information of value in planning engineering work is given throughout the text, especially in sections "Descriptions of the Soils" and "Formation and Classification of Soils." Some terms used by the soil scientist may be unfamiliar to the engineer, and some words—for example, clay, silt, and sand—may have special meaning in soil science. These and other special terms used in the soil survey are defined in the Glossary at the back of this survey.

Most of the information in this section is presented in tables 3, 4, and 5, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in these tables. It also can be used to make other useful maps.

Engineering Classification Systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*11*) used by Soil Conservation Service engineers, the Department of Defense, and others, and the AASHO system (*1*) adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example ML-CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 6; the estimated classification, without group index numbers, is given in table 4 for all soils mapped in the survey area.

Estimated Engineering Properties

The estimated soil properties significant to engineering are shown in table 3. Information obtained during the soil survey and knowledge of the individual soils of the survey area were used as a basis for the estimates in this table.

The meaning of hydrologic groups shown in table 3 may not be familiar to some persons who use this survey. These data are used in estimating the total volume and peak runoff that can be expected from storms of a given amount and intensity. The data are useful in planning measures to control water.

In group A are coarse textured and moderately coarse textured soils that transmit water through their profile at a rapid rate. These soils absorb the precipitation that falls in most storms, and they have the highest rate of infiltration, even when they are thoroughly wet, and the lowest runoff potential.

In group B are the moderately coarse textured to moderately fine textured, deep or very deep soils that transmit water through their profile at a moderate rate. These soils have a moderate runoff potential.

In group C are the moderately coarse textured to fine-textured, deep to shallow soils that transmit water through their profile at a slow rate. These soils have a high runoff potential.

In group D are the medium-textured, moderately fine textured, and fine textured soils. Some soils in this group have a high water table, some have a thin mantle of soil over impervious material, some have a surface layer consisting of impervious material, and some are very deep. Soils in group D have the highest runoff potential of any soils in the survey area.

TABLE 3.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil, which may in the first colum of this table. The symbol >

Soil series and map symbols	Depth to seasonal water table [1] [2]	Depth to bedrock	Hydrologic group [1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
*Agassiz: AAE, AAG2, ABG2, ADG2, AEG2, AGE, AGG2. For properties of Bradshaw soil in ABG2, of Dateman soil in ADG2, of Elwood soil in AEG2, and of Goring soil in AGE and AGG2, refer to their respective series.	--------	10–20	D	0–18	Very cobbly silt loam and very cobbly silty clay loam.	GM or ML	A-4 or A-2
				18	Fractured limestone bedrock.		
*Airport: AhA, Ak, Am. For properties of Salt Lake soil in Am, refer to the Salt Lake series.	0–40	>60	D	0–60	Silt loam, silty clay loam, clay loam, or loam.	CL or ML	A-4 or A-6
*Ant Flat: AND, AOE2. For properties of Despain soil in AOE2, refer to the Despain series.	--------	40–60+	C	0–11	Loam or clay loam	CL or ML	A-4 or A-6
				11–60	Clay to clay loam	CH or CL	A-7 or A-6
*Avon: ArA, ArB, ArC, ArD, AsC, AsE. For properties of Collinston soil in AsC and AsE, refer to the Collinston series.	--------	>60	B	0–12	Silty clay loam	ML or CL	A-4 or A-6
				12–27	Silty clay	CL	A-6
				27–60	Silty loam or silty clay loam.	CL or ML	A-6 or A-4
*Barfuss: BAF. For properties of Leatham soil, refer to the Leatham series.	--------	>60	B	0–60	Silty clay loam and silt loam.	CL or ML	A-4 or A-6
Battle Creek: BcA, BcD	--------	>60	C	0–72	Silty clay	CL or CH	A-7
*Bickmore: BGG, BKG2, BLG2. For properties of Agassiz soil in BKG2, and of Sheep Creek soil in BLG2, refer to their respective series.	--------	40	C	0–16	Gravelly silt loam	ML	A-4
				16–37	Cobbly silty clay loam and very cobbly silty clay loam.	GM or ML	A-4 or A-2
				37	Bedrock.		
Blackrock: BmB, BmC, BmD, BnD	--------	>60	B	0–60	Gravelly loam and gravelly clay loam.	SM or ML	A-4
*Bradshaw: BSG2. For properties of Agassiz soil, see Agassiz series.	--------	>60	B	0–14	Silt loam	ML or CL	A-4
				14–60	Cobbly loam and very cobbly loam.	ML or GM	A-4
Cache: Ca	0–20	>60	D	0–72	Silty clay	CH	A-7
Cardon: Cd	30 (40–60)	>60	D (B)	0–62	Silty clay	CH	A-7
Center Creek: CE	[3] 20–40	>60	B	0–15	Silt loam and silty clay loam.	CL or OL	A-7
			C	15–60	Stratified silty clay loam, very fine sandy loam.	CL or ML	A-6
Clegg: CFE	--------	>60	B	0–20	Silt loam and loam	ML	A-4
				20–60	Very cobbly very fine sandy loam.	GM	A-2
*Cluff: CGE, CHE, CIE. For properties of Lucky Star soil in CHE, and of Scout soil in CIE, refer to their respective series.	--------	>60	B	0–9	Silt loam	ML or SM	A-4
				9–31	Very gravelly loam	GM	A-2
				31–62	Very gravelly clay loam.	GC	A-2

See footnotes at end of table.

significant to engineering

have different properties and limitations. For this reason the reader should follow carefully the instructions for referring to other series means more than, and the symbol < means less than]

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
30–60	50–80	30–70	25–60	0.63–2.0	0.08–0.12	6.6–7.8	None	Low.
0	100	100	50–90	<0.2	0.12–0.15	7.9–9.6	Slight to severe	Moderate.
0	100	90–100	70–85	0.20–0.63	0.16–0.20	6.1–7.3	None	Moderate.
0	100	85–100	70–90	0.06–0.20	0.14–0.18	6.1–8.4	None	High.
0	100	100	75–95	0.63–2.0	0.18–0.20	6.6–7.3	None	Moderate.
0	100	100	85–95	0.20–0.63	0.15–0.17	6.6–7.8	None	High.
0	100	60–90	75–95	0.63–2.0	0.18–0.20	7.9–8.4	None	Moderate.
0	100	100	75–95	0.20–0.63	0.18–0.21	6.6–9.0	None	Moderate.
0	100	100	90–100	0.06–0.20	0.15–0.17	6.6–8.4	None	High.
0–15	60–90	50–85	50–80	0.63–0.20	0.14–0.16	6.1–7.3	None	Low.
25–40	30–80	25–70	15–60	0.63–0.20	0.10–0.12	5.6–8.4	None	Low.
0–5	55–80	50–75	35–50	0.63–2.0	0.14–0.16	6.6–7.8	None	Low.
0	80–100	75–100	60–75	0.63–2.0	0.18–0.20	6.1–7.3	None	Low.
25–40	40–80	25–65	35–60	0.63–6.3	0.08–0.12	6.6–8.4	None	Low.
0	100	100	90–100	<0.063	0.04–0.06	7.4–9.0	Very severe	High.
0	100	100	90–100	<0.063	0.15–0.17	7.5–9.0	None	High.
0	100	100	90–95	0.20–0.63	0.20–0.25	5.6–7.3	None	Moderate.
0	100	100	20–90	0.20–0.63	0.18–0.22	6.1–7.3	None	Moderate.
0	100	90–100	80–95	0.63–2.0	0.18–0.20	6.1–6.5	None	Low.
15–40	40–60	20–40	15–35	0.63–2.0	0.07–0.10	6.6–7.8	None	Low.
0	85–100	60–100	45–75	0.63–2.0	0.15–0.20	5.6–6.5	None	Low.
10–30	50–75	40–50	25–35	0.63–2.0	0.08–0.10	5.1–6.5	None	Low.
10–30	40–55	35–50	25–35	0.63–2.0	0.09–0.11	5-1–6.4	None	Moderate.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table [1] [2]	Depth to bedrock	Hydrologic group [1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
Collett: Ck	20–36 (40–60)	>60	C	0–60	Heavy silty clay loam	CL	A–6 or A–7
Collinston: ClA, CmC, CmD, CmE2		>60	B	0–60	Loam, silt loam, and clay loam.	ML	A–4
Crookston: CoA, CoB, CoC		>60	B	0–60	Loam and fine sandy loam.	CL or ML	A–4
Crowshaw: CrB, CrC, CrD		>60	B	0–60	Gravelly loam	SM or ML	A–4
*Curtis Creek: CSE, CSG For properties of Goring soil, refer to the Goring series.		13–20	D	0–18	Loam and sandy clay loam.	ML	A–4
				18	Fractured and weathered sandstone.		
Dagor: DaC, DaD		>60	B	0–60	Silt loam	ML	A–4
*Dateman: DEG, DHG For properties of Bradshaw soil in DHG, refer to the Bradshaw series.		26–40	C	0–24	Cobbly silt loam	ML	A 4
				24–34	Very cobbly silty clay loam.	GM	A–2 or A–4
				34	Fractured and weathering limestone bedrock.		
*Datwyler: DLG, DNG For properties of Elzinga and Maughan soils in DNG, refer to their respective series.		32–40	C	0–35	Very cobbly clay and very cobbly sandy clay loam.	GC	A–2 or A–6
				35	Fractured limestone bedrock.		
*Despain: DPG, DSG For properties of Bickmore soil in DPG, and of Lucky Star soil in DSG, refer to their respective series.		>60	B	0–16	Gravelly loam or loam	ML	A–4
				16–60	Gravelly clay loam and gravelly loam.	GM, GC, or CL	A–4 or A–2
*Elwood: EDG, EGE, EME, EMG For properties of Agassiz soil in EGE, and of Mult soil in EME and EMG, refer to their respective series.		20–40	C	0–11	Silt loam	ML	A–4
				11–38	Cobbly silty clay loam and very cobbly silty clay loam.	GM or ML	A–2
				38	Fractured limestone.		
Elzinga Mapped only with the Datwyler and Hoskins soils.		>60	B	0–22	Silt loam	ML or OL	A–4
				22–48	Cobbly silt loam	GM or ML	A–4
				48–62	Mixed very cobbly very fine sandy loam and very cobbly clay loam.	GM	A–2
				62	Fractured sandstone.		
Fitzgerald: FGD		>60	B	0–37	Extremely stony loam and very gravelly sandy clay loam.	GM	A–2 or A–4
				37–60	Very gravelly fine sandy loam.	GM	A–2
Flygare: FLD		>60	B	0–27	Silt loam or cobbly silt loam.	OL or ML	A–4
				27–65	Cobbly sandy clay loam and very cobbly sandy loam.	SM or ML	A–4 or A–2

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
0	100	95–100	85–100	0. 06–0. 20	0. 18–0. 21	7. 4–8. 4	None to slight	High.
0	100	85–100	70–90	0. 63–2. 0	0. 16–0. 18	7. 4–8. 4	None	Low.
0	100	95–100	50–70	0. 63–2. 0	0. 16–0. 18	7. 4–7. 8	None	Low.
0	55–80	50–75	35–55	0. 63–2. 0	0. 12–0. 14	6. 1–7. 3	None	Low.
0–5	10–95	60–90	55–70	0. 63–2. 0	0. 12–0. 16	5. 6–7. 3	None	Low.
0	90–100	70–95	60–90	0. 63–2. 0	0. 18–0. 20	6. 8–7. 3	None	Low.
15–40	60–90	55–85	50–80	0. 63–2. 0	0. 11–0. 14	6. 6–7. 3	None	Low.
20–50	35–55	30–50	15–45	0. 63–2. 0	0. 08–0. 10	7. 4–7. 8	None	Low.
20–50	25–55	20–50	15–45	0. 20–0. 63	0. 08–0. 10	6. 1–9. 0	None	Low to moderate.
10–15	75–95	70–90	50–70	0. 63–2. 0	0. 13–0. 16	6. 1–7. 8	None	Low.
10–15	40–80	35–75	25–60	0. 63–2. 0	0. 10–0. 14	6. 1–8. 4	None	Moderate.
0	85–100	80–95	70–85	0. 63–2. 0	0. 16–0. 18	5. 6–6. 5	None	Low.
10–40	40–80	35–70	25–60	0. 63–2. 0	0. 10–0. 14	6. 1–7. 3	None	Low.
0	100	90–100	80–90	0. 63–2. 0	0. 20–0. 24	5. 6–6. 5	None	Low.
10–25	50–80	40–70	35–60	2. 0–6. 3	0. 11–0. 15	5. 6–6. 5	None	Low.
20–50	50–70	40–50	20–35	2. 0–6. 3	0. 10–0. 12	5. 6–6. 5	None	Low.
15–50	30–85	25–80	20–50	0. 63–2. 0	0. 08–0. 16	5. 1–6. 5	None	Low.
10–35	20–60	10–50	10–35	>6. 3	0. 07–0. 10	5. 1–6. 5	None	Low.
0	70–100	50–100	40–80	0. 63–2. 0	0. 17–0. 25	6. 0–6. 5	None	Low.
10–40	50–80	40–70	25–60	0. 63–2. 0	0. 11–0. 14	5. 6–6. 5	None	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table[1][2]	Depth to bedrock	Hydrologic group[1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
Foxol: FOG	--------	14–20	D	0–17	Gravelly loam, very gravelly loam, and very gravelly sandy loam.	GM or SM	A-4 or A-2
				17	Fractured quartzite rock.		
*Goring: GGE, GOE2. For properties of Obray soil in GOE2, refer to the Obray series.	--------	>60	C	0–60	Heavy silty clay loam and silty clay.	CL or CH	A-7
Gravel pit: Gp. No valid estimates can be made.							
Green Canyon: GrA, GrB	--------	>60	B	0–16	Gravelly loam	ML	A-4
				16–60	Very gravelly fine sandy loam and very gravelly loamy sand.	GM	A-1
Greenson: GsA, GsB, GsC, GuA, GvA	30–40 (40–60)	>60	C (B)	0–72	Loam or silt loam	ML	A-4
Hendricks: HdA, HdB, HdC, HdD	--------	>60	B	0–60	Silt loam and silty clay loam.	CL or ML	A-6 or A-4
Hiibner: HeC, HeD, HeE, HfE	--------	>60	C	0–60	Very cobbly clay	GC	A-6 or A-2
*Hillfield: HgE2, HhE2. For properties of Timpanogos soil in HhE2, refer to the Timpanogos series.	--------	>60	B	0–60	Stratified silt loam and sandy loam.	ML or SM	A-4
*Hoskin: HIB, HKG2, HLG2, HMG2, HNG, HOG2, HSG2. For properties of Datwyler soil in HLG2, of Elzinga soil in HMG2, of Scave soil in HNG, of Scout soil in HOG2, and of Smarts soil in HSG2, refer to their respective series.	--------	24–40	C	0–28	Very cobbly loam	GM	A-2 or A-4
				28	Consolidated, weathering conglomerate.		
Hyrum: HuC, HuE, HyC	--------	>60	B	0–17	Gravelly loam	ML	A-4
				17–60	Very cobbly clay loam and very cobbly loam.	GM	A-2 or A-1
*Jordan: Jo, Jr. For properties of Lasil soil in Jr, refer to the Lasil series.	30–48	>60	D	0–68	Silty clay and silty clay loam.	CH or MH	A-7
Kidman: KdA, KdD, KfA, KfB, KfC	40–60+	>60	B	0–43	Fine sandy loam	SM	A-4
				43–60	Fine sandy loam to fine sand.	SM	A-2 or A-1
*Kirkham: Ks, Kt. For properties of Shay soil, refer to the Shay series.	30–50	>60	C	0–60	Stratified silty clay loam and silt loam.	CL or ML	A-4 or A-7
Lakewin: La	--------	>60	A	0–34	Gravelly coarse sandy loam and gravelly loamy sand.	SM–SP or SM	A-1 or A-2
				34–60	Very gravelly sand	GP–GM or GM	A-1

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
5-25	45-80	35-70	20-50	0. 63-2. 0	0. 08-0. 10	5. 6-6. 5	None	Low.
0	100	80-100	70-95	0. 06-0. 20	0. 14-0. 20	6. 1-7. 3	None	High.
0	70-90	60-80	50-70	2. 0-0. 63	0. 12-0. 14	7. 9-8. 0	None	Low.
5-15	50-70	20-50	10-25	6. 3-20. 0	0. 03-0. 05	7. 9-9. 0	None	Low.
0	100	100	60-90	0. 63-2. 0	0. 15-0. 19	7. 4-9. 0	None	Moderate.
0	100	85-100	80-95	0. 63-2. 0	0. 18-0. 20	6. 1-7. 3	None	Moderate.
0-50	30-60	25-50	20-45	0. 06-0. 20	0. 08-0. 10	6. 1-7. 8	None	Moderate.
0	100	90-100	40-80	0. 63-2. 0	0. 12-0. 17	7. 4-8. 4	None	Low.
10-40	30-65	20-50	15-40	2. 0-6. 3	0. 07-0. 10	6. 1-7. 3	None	Low.
5-10	75-85	60-80	50-75	2. 0-6. 3	0. 12-0. 14	6. 6-7. 3	None	Low.
15-60	35-65	20-50	20-35	0. 63-2. 0	0. 08-0. 10	6. 6-7. 8	None	Low.
0	100	100	90-100	<0. 06	0. 03-0. 05	7. 9-9. 6	Severe to very severe.	High.
0	100	100	35-50	2. 0-6. 3	0. 13-0. 50	6. 6-8. 4	None	Low.
0	100	100	10-35	2. 0-6. 3	0. 09-0. 11	7. 9-9. 0	None	Low.
0	100	100	60-95	0. 20-0. 63	0. 18-0. 20 (0. 08-0. 10 in Kt).	7. 4-9. 0	None to moderate.	Moderate.
0	55-85	50-80	10-30	6. 3-20. 0	0. 05-0. 07	6. 6-7. 8	None	Low.
0	15-55	10-50	5-20	>20	0. 03-0. 05	7. 4-9. 0	None	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table[1][2]	Depth to bedrock	Hydrologic group[1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
*LaPlatta: LCG, LGE. For properties of Obray soil in LGE, refer to the Obray series.	--------	>60	B	0–60	Clay, silty clay, and silty clay loam.	CH or CL	A–7 or A–6
Lasil. Mapped only with soils of the Jordan series.	32–40	>60	D	0–60	Heavy silty clay loam	CH	A–7
Layton: Lh	40–60	>60	A	0–66	Loamy fine sand	SM	A–2
*Leatham: LMG2. For properties of Barfuss soil, refer to the Barfuss series.	--------	>60	B	0–60	Silt loam and silty clay loam.	ML or CL	A–4 or A–6
Lewiston: Ln, Lo	10–30 (30–40)	>60	C (B)	0–32	Fine sandy loam	SM or ML	A–2 or A–4
				60	Stratified loamy fine sand.	SM	A–2 or A–4
Logan: Lr	0–40 (40–60)	>60	D (C)	0–60	Heavy silty clay loam and silty clay.	CL or CH	A–7
*Lucky Star: LSE, LTG, LUE, LVE, LWE, LXE. For properties of Goring soil in LUE, of Hoskin soil in LVE, of Red Spur soil in LWE, and of Scout soil in LXE, refer to their respective series.	--------	>60	B	0–13	Silt loam, gravelly silt loam, or extremely stony silt loam.	OL, ML, or SM	A–4
				13–72	Very cobbly fine sandy loam and very cobbly sandy clay loam.	GM or SM	A–2
*Maughan: MAG. For properties of Datwyler soil, refer to the Datwyler series.	--------	>60	B	0–25	Silt loam	OL or ML	A–4
				25–60	Cobbly clay	CH or CL	A–7 or A–6
*McMurdie: McA, McB, McC, MdE2. For properties of Hillfield soil in MdE2, refer to the Hillfield series.	--------	>60	B	0–14	Silt loam and silty clay loam.	CL or ML	A–4
				14–60	Silty clay, silty clay loam, and sandy loam.	CH or CL	A–7 or A–6
*Mendon: MeA, MeB, MeC, MfB, MfE2. For properties of Collinston soil in MfB and MfE2, refer to the Collinston series.	--------	>60	B	0–60	Clay loam and loam	CL or ML	A–7 or A–6
Middle. Mapped only with soils of the Richmond series.	--------	24–40	C	0–28	Cobbly loam and very cobbly loam.	GM	A–2 or A–4
				28	Bedrock.		
Millville: MIA, MIB	[4] 40–50	>60	B	0–65	Silt loam	ML	A–4
Mixed alluvial land: Mm. No valid estimates can be made.							
*Mult: MNE, MNG2, MSE. For properties of Agassiz soil in MNE and MNG2, and of Lucky Star soil in MSE, refer to their respective series.	--------	22–40	C	0–24	Silt loam and silty clay loam.	ML or CL	A–4 or A–6
				24	Fractured limestone rock.		

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
0	100	100	85–95	0. 20–0. 63	0. 16–0. 20	6. 1–9. 0	None	High.
0	100	100	90–100	<0. 06	0. 05–0. 10	6. 6–9. 6	Slight to severe	High.
0	100	90–100	10–25	6. 3–20. 0	0. 09–0. 11	6. 6–8. 4	None	Low.
0	100	95–100	80–95	0. 63–2. 0	0. 18–0. 20	6. 6–8. 6	None	Moderate.
0	100	100	25–60	2. 0–6. 3	0. 13–0. 15	7. 4–9. 0	None to moderate	Low.
0	100	100	15–50	0. 63–6. 3	0. 08–0. 12	8. 5–9. 6	Severe to moderate.	Low.
0	100	100	85–100	0. 06–0. 20	0. 15–0. 17	7. 4–8. 4	None to slight	High.
5–10	60–90	55–85	40–75	0. 63–2. 0	0. 17–0. 25	6. 0–6. 8	None	Low.
25–40	50–70	45–65	15–35	0. 63–2. 0	0. 08–0. 10	5. 6–7. 3	None	Low.
0	95–100	85–100	75–90	0. 63–2. 0	0. 20–0. 22	5. 0–6. 5	None	Low.
10–25	60–90	50–80	35–65	0. 20–0. 63	0. 12–0. 14	6. 1–7. 3	None	High.
0	100	90–100	70–95	0. 20–0. 63	0. 18–0. 21	6. 6–7. 3	None	Moderate.
0	100	95–100	80–95	0. 20–0. 63	0. 16–0. 18	6. 6–7. 8	None	High.
0	100	100	75–95	0. 20–0. 63	0. 18–0. 21	6. 6–8. 4	None	Moderate.
15–50	40–60	30–50	25–40	0. 63–2. 0	0. 08–0. 12	6. 6–8. 4	None	Low.
0	100	100	70–90	0. 63–2. 0	0. 16–0. 20	7. 4–8. 4	None	Low.
0	90–100	80–100	70–90	0. 63–2. 0	0. 18–0. 20	5. 6–7. 3	None	Moderate.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table[1] [2]	Depth to bedrock	Hydrologic group [1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
*Munk: MoG2 For properties of Blackrock soil, refer to the Blackrock series.	--------	20–40	C	0–36	Gravelly loam and very gravelly loam.	GM	A-1, A-2, or A-4
				36	Salt Lake Geologic Formation materials, partially consolidated.		
Nebeker: NbB, NbC, NbE	--------	>60	B	0–14	Silt loam	ML or CL	A-4 or A-6
				14–70	Clay or heavy silty clay loam.	CL or CH	A-7
Nibley: NcA, NcB	30-40 (50–60)	>60	C	0–60	Silty clay and heavy silty clay loam.	CH or CL	A-7
Obray: ObB	--------	>60	D	0–60	Silty clay	CH	A-7
Parleys: PaA, PaB, PaC	--------	>60	B	0–68	Silt loam and clay loam.	CL or ML	A-6 or A-4
Parlo: PlA, PlB, PlC	--------	>60	B	0–30	Silt loam and silty clay loam.	CL or ML	A-6 or A-4
				30–60	Very gravelly loamy sand.	GM	A-1
Payson: Pn	30–50	>60	D	0–60	Silty clay	CL or CH	A-7 or A-6
*Picayune: POG2, PRG For properties of Agassiz soil in POG2, and of Smarts soil in PRG, refer to their respective series.	--------	>60	B	0–60	Gravelly clay loam	SM or ML	A-4
*Poleline: PSG2 For properties of Agassiz soil, refer to the Agassiz series.	--------	40–60+	B	0–60	Gravelly to very gravelly loam.	ML or SM	A-4
Preston: PtC	--------	>60	A	0–64	Fine sand	SM or SP-SM	A-3 or A-2
Provo: Pu, Pv	26–36 (50–60)	>60	C (A)	0–13	Gravelly loam	SM	A-4
				13–60	Very gravelly loam and very gravelly sandy loam.	GM	A-1
Quinney: Qu	30–50	>60	B	0–39	Silt loam and loam	ML	A-4
				39–60	Silty clay	CL	A-6
*Red Spur Mapped only with soils of the Lucky Star series.	--------	48–60+	B	0–48	Loam and fine sandy loam.	ML or SM	A-4 or A-2
				48–56	Cobbly sandy clay loam.	CL or SC	A-4
				56	Bedrock.		
*Richmond: RCG2, RDG2, REG2, RFG2, RGG2. For properties of Middle soil in RDG2, of Munk soil in REG2, of Nebeker soil in RFG2, and of Sterling soil in RGG2, refer to their respective series.	--------	10–20	D	0–18	Very stony loam and very cobbly loam.	GM or ML	A-2
				18	Fractured bedrock.		

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
5–15	50–70	20–50	10–50	0. 63–2. 0	0. 08–0. 10	7. 4–9. 0	None	Low.
0	90–100	90–100	70–90	0. 63–2. 0	0. 16–0. 20	5. 6–7. 3	None	Moderate.
0	90–100	90–100	80–95	0. 20–0. 63	0. 15–0. 20	6. 1–7. 8	None	High.
0	100	100	85–95	0. 06–0. 20	0. 16–0. 18	6. 6–9. 0	None	High.
0	100	100	90–95	<0. 063	0. 20–0. 22	6. 0–6. 5	None	High.
0	100	95–100	80–95	0. 2–0. 63	0. 18–0. 20	6. 6–8. 4	None	Moderate.
0	100	90–100	85–95	0. 63–2. 0	0. 16–0. 18	6. 6–7. 8	None	Moderate.
0	50–80	20–50	15–25	>6. 3	0. 04–0. 06	7. 4–8. 4	None	Low.
0	100	100	80–95	<0. 063	0. 04–0. 06	7. 4–10. 0	Slight to high	High.
10–20	60–70	50–80	35–65	0. 63–2. 0	0. 12–0. 15	6. 6–9. 0	None	Low.
5–20	50–90	40–80	35–65	2. 0–6. 3	0. 12–0. 15	5. 6–7. 3	None	Low.
0	100	100	5–20	>2. 0	0. 03–0. 05	6. 6–8. 4	None	Low.
0	60–80	50–70	35–50	0. 63–2. 0	0. 15–0. 17	7. 4–8. 4	None	Low.
0	30–60	20–50	10–25	2. 0–6. 3	0. 04–0. 06	7. 4–8. 4	None	Low.
0	100	100	70–80	0. 63–2. 0	0. 10–0. 12	8. 4–9. 6	Slight to severe	Moderate.
0	100	100	75–95	0. 06–0. 20	0. 04–0. 06	8. 5–10. 0	Moderate to severe.	High.
0	80–95	60–90	30–60	0. 63–2. 0	0. 08–0. 12	5. 8–6. 5	None	Low.
15–35	60–90	50–80	30–60	0. 63–2. 0	0. 10–0. 12	5. 6–6. 5	None	Low.
15–35	50–80	20–70	15–35	2. 0–6. 3	0. 08–0. 10	7. 4–8. 4	None	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table [1][2]	Depth to bedrock	Hydrologic group [1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
Ricks: RhA, RhB, RhC	--------	>60	A	0–18	Gravelly loam and gravelly sandy loam.	ML, SM, or GM	A–4 or A–2
				18–60	Very gravelly sand	GM or GP–GM	A–1
Riverwash: Rk. No valid estimates can be made.							
Rock land: RO. No valid estimates can be made.							
Roshe Springs: Rs	0–36 (30–60)	>60	C (B)	0–60	Silt loam	ML	A–4
Rough broken land: Rt. No valid estimates can be made.							
*St. Marys: SAG, SCG For properties of Curtis Creek soil in SCG, refer to the Curtis Creek series.	--------	40–60+	B	0–60	Gravelly fine sandy loam and very cobbly fine sandy loam.	GM	A–2 or A–1
*Salt Lake: Sd, Se, Sf, Sg, Sh. For properties of Logan soil in Sf, of the Roshe Springs soil in Sg, and of the Trenton soil in Sh, refer to their respective series.	0–30 (30–60)	>60	D	0–66	Silty clay	CH	A–7
Scave: SIE, SKE	--------	>60	C	0–16	Silt loam	ML or OL	A–4
				16–34	Cobbly loam	GM or SM	A–4 or A–2
				34–60	Very cobbly clay	GC	A–2
Scout: SLG	--------	>60	B	0–18	Light loam	ML or SM	A–4
				18–62	Very gravelly very fine sandy loam and very gravelly sandy loam.	GM	A–2 or A–4
Shay: Sm	30–50	>60	C	0–30	Silty clay loam and silty clay.	CH or CL	A–7 or A–6
				30–60	Stratified silt loam to sandy loam.	CL or ML	A–6 or A–4
*Sheep Creek: SNG2, SOG2, SPG2, SRG2. For properties of Agassiz soil in SOG2, of Despain soil in SPG2, and of Maughan soil in SRG2, refer to their respective series.	--------	26–40	C	0–28	Very cobbly clay loam and very cobbly loam.	GM	A–4 or A–2
				28	Fractured limestone bedrock.		
*Smarts: SSE, STG2, SUG For properties of Hoskin soil in STG2, and Lucky Star and Poleline soil in SUG, refer to their respective series.	--------	>60	B	0–22	Silt loam or gravelly silt loam.	ML or OL	A–4
				22–60	Very cobbly loam	GM	A–2
Steed: SvA, SvB, SvC	--------	>60	A	0–17	Gravelly loam and very gravelly sandy loam.	ML or GM	A–4 or A–2
				17–60	Very gravelly loamy sand.	GM	A–1 or A–2

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
0	35–90	30–85	20–65	2.0–6.3	0.12–0.14	6.6–7.8	None	Low.
0–10	25–35	20–30	5–25	>2.0	0.03–0.05	7.8–8.4	None	Low.
0	100	100	70–90	0.63–2.0	0.16–0.18	8.4–9.0	None to slight	Low to moderate.
15–35	30–60	20–50	10–35	2.0–6.3	0.06–0.10	6.1–7.8	None	Low.
0	100	100	90–100	<0.2	0.18–0.20	7.4–9.0	None to slight	High.
0	90–100	80–95	65–85	0.63–2.0	0.22–0.25	5.6–6.5	None	Low.
10–35	60–80	30–70	25–50	0.63–2.0	0.08–0.11	5.6–6.5	None	Low.
25–40	35–50	20–40	15–30	0.06–0.20	0.08–0.10	5.6–6.5	None	Moderate.
0	75–100	60–95	30–70	2.0–6.3	0.13–0.17	5.1–7.3	None	Low.
0–10	30–70	35–50	15–45	2.0–6.3	0.06–0.10	5.1–6.5	None	Low.
0	100	100	85–100	0.063–0.20	0.16–0.18	6.6–8.4	None to slight	Moderate to high.
0	100	100	50–90	0.063–2.0	0.16–0.18	7.4–9.0	None to slight	Moderate.
10–40	35–75	20–60	15–50	0.63–2.0	0.08–0.12	6.6–8.4	None	Low.
0–10	75–100	60–90	50–75	0.63–2.0	0.14–0.18	6.1–7.0	None	Low.
15–35	30–70	15–50	15–35	0.63–2.0	0.10–0.13	6.1–7.3	None	Low.
0–15	30–90	45–80	30–65	2.0–6.30	0.10–0.15	7.4–7.8	None	Low.
0–15	50–70	20–50	10–25	>2.0	0.04–0.06	7.4–7.8	None	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table[1][2]	Depth to bedrock	Hydrologic group[1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
Sterling: SwC, SwD, SwF2	--------	>60	A	0–16	Gravelly loam	GM or SM	A-4 or A-2
				16–60	Very gravelly sandy loam and very gravelly loamy sand.	GP-GM or GM	A-1
Stony alluvial land: Sy. No valid estimates can be made.							
Timpanogos: TmA, TmB, TmC, TmD2, TnA.	[4] 36–54	>60	B	0–60	Loam	ML	A-4
Trenton: TrA, TrB, TrC, TrD2, TtA	[5] 40–60	>60	C	0–60	Silty clay	CH	A-7
*Wheelon: WhE, WhF2, WlE2 For properties of Collinston soil in WlE2, refer to the Collinston series.	--------	24–>60	C	0–66	Silt loam and silty clay loam.	ML	A-4
*Winn: Wn, Wp For properties of Provo soil in Wp, refer to the Provo series.	30–50	>60	C (B)	0–60	Loam and stratified silt loam.	ML	A-4
Woods Cross: Wr	10–30	>60	D	0–36	Heavy clay loam	OL or CH	A-7
				36–60	Stratified loam	CL or ML	A-6 or A-4
Yeates Hollow: YHE, YHG, YLE2	--------	40–>60	C	0–11	Extremely stony silt loam.	SM or ML	A-4
				11–46	Very cobbly clay loam and very cobbly clay. Fractured quartzite and sandstone rock.	GC	A-2

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[1] Values or letter symbols enclosed by parentheses refer to conditions where the soil has been drained.

[2] Dashes in this column mean that there was no water table within the depth of observation, which is 5 feet unless limited by bedrock.

[3] Seasonal water table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
0–15	50–90	40–70	25–50	2.0–6.3	0.10–0.12	7.4–8.9	None	Low.
0–15	30–50	10–50	5–25	0.63–2.0	0.04–0.06	7.9–9.0	None	Low.
0	100	90–100	60–80	0.63–2.0	0.16–0.18	6.6–8.4	None	Moderate.
0	100	100	85–100	0.06–0.2	0.14–0.17	7.4–9.6	Slight to severe	High.
0	100	90–100	85–95	0.20–0.63	0.08–0.12	7.4–9.0	None	Moderate.
0	90–100	75–100	50–70	0.63–6.3	0.16–0.18	7.4–8.9	None	Moderate.
0	100	100	70–90	0.06–0.20	0.16–0.19	6.6–7.8	None	High.
0	100	70–100	50–90	0.2–2.0	0.14–0.18	7.4–8.4	None	Moderate.
5–10	60–90	50–85	35–65	0.63–2.0	0.10–0.12	6.1–7.3	None	Low.
15–40	30–60	20–50	15–35	0.06–0.20	0.08–0.10	5.6–7.3	None	Moderate.

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[4] Depth to water table where natural drainage is moderately good. Where natural drainage is good, there is no water table within the depth of observations.

[5] Depth to water table where natural drainage is moderately good. Where natural drainage is somewhat poor, the depth to water table is 20 to 40 inches.

TABLE 4.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of at least two or more kinds of soil, which series in the first

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Agassiz: AAE, AAG2, ABG2, ADG2, AEG2, AGE, AGG2. For interpretations of Bradshaw soil in ABG2, of Dateman soil in ADG2 of Elwood soil in AEG2, and of Goring soil in AGE and AGG2, refer to their respective series.	Poor: very cobbly.	Not suitable: very cobbly; poorly graded; excessive fines.	Good to fair: A–2 or A–4 material.	Bedrock at a depth of 10 to 20 inches; slopes of 6 to 70 percent; very cobbly.	Bedrock at a depth of 10 to 20 inches; slopes of 6 to 70 percent.	Medium shear strength; susceptible to piping; semipervious; very cobbly; bedrock at a depth of 10 to 20 inches; low to medium compressibility.
*Airport: AhA, Ak, Am---- For interpretations of Salt Lake soil in Am, refer to the Salt Lake series.	Poor: alkali; salts.	Not suitable: excessive fines.	Fair to poor: A–4 and A–6 material.	Poor embankment material; high water table; high frost-heave potential.	High water table; slopes of 0 to 3 percent.	Low to medium shear strength; semipervious to impervious.
*Ant Flat: AND, AOE2--- For interpretations of Despain soil in AOE2, refer to the Despain series.	Fair in upper 12 inches.	Not suitable: excessive fines.	Poor: dominantly A–4, A–6, and A–7 material.	Poor embankment material; slopes of 6 to 30 percent; high plasticity; high organic-matter content in upper 7 inches.	Slopes of 6 to 30 percent.	Low shear strength; impervious; high compressibility.
*Avon: ArA, ArB, ArC, ArD, AsC, AsE. For interpretations of Collinston soil in AsC and AsE, refer to the Collinston series.	Fair in upper 12 inches: silty clay loam.	Not suitable: excessive fines.	Fair to poor: A–4 and A–6 material.	Fair embankment material; moderate frost-heave potential; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Medium to low shear strength; semipervious to impervious; medium compressibility; subject to piping.
*Barfuss: BAF----------- For interpretations of Leatham soil, refer to the Leatham series.	Good in upper 10 inches.	Not suitable: excessive fines.	Fair to poor: A–4 and A–6 material.	Fair embankment material; moderate frost-heave potential; slopes of 10 to 50 percent; high organic-matter content in upper 8 inches.	Slopes of 10 to 50 percent.	Susceptible to piping; semipervious to impervious; medium to low shear strength.
Battle Creek: BcA, BcD---	Poor in upper 12 inches: silty clay.	Not suitable: excessive fines.	Poor: A–7 material.	Poor embankment material; high plasticity; high shrink-swell potential; slopes of 0 to 20 percent.	Soil features favorable; slopes of 0 to 20 percent.	Low to medium shear strength.

interpretations of soils

may have different properties and limitations. For this reason the reader should follow carefully the instructions for referring to other column of this table]

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable.	Not applicable.	Not applicable.	Not applicable.	Moderate to severe: slopes of 6 to 70 percent.	Severe: bedrock at a depth of 10 to 20 inches; slopes of 6 to 70 percent.	Severe: bedrock at a depth of 10 to 20 inches; slopes of 6 to 70 percent.
Slow and very slow permeability; high water table.	High water table; slight to severe salinity, affected by alkali.	Not applicable.	Not applicable.	Severe: water table at a depth of 0 to 40 inches; somewhat poorly and poorly drained.	Severe: slow and very slow permeability; water table at a depth of 0 to 40 inches.	Moderate: moderate shrink-swell potential; high water table.
Not applicable.	Not applicable.	Not applicable.	Not applicable.	Severe: slopes of 6 to 30 percent; high shrink-swell potential.	Severe: slow permeability; fine texture; slopes of 6 to 30 percent.	Severe: slopes of 6 to 30 percent.
Not applicable.	Slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Severe: high shrink-swell potential.	Severe: moderately slow permeability; slopes of 0 to 20 percent.	Slight to severe: high shrink-swell potential; slopes of 0 to 20 percent.
Not applicable.	Slopes of 0 to 50 percent; moderately slow permeability.	Slopes of 0 to 50 percent; moderately slow permeability.	Slopes of 0 to 50 percent.	Moderate to severe: slopes of 0 to 50 percent; moderate shrink-swell potential.	Severe: slopes of 0 to 50 percent; moderately slow permeability.	Severe: slopes of 0 to 50 percent.
Not applicable.	Moderately slow intake rate; slopes of 0 to 20 percent.	Slow permeability; fine-textured subsoil; slopes of 0 to 20 percent.	Fine textured; subject to cracking; slopes of 0 to 20 percent.	Severe: high shrink-swell potential.	Severe: slow permeability; slopes of 0 to 20 percent.	Slight to severe: slopes of 0 to 20 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Bickmore: BGG, BKG2, BLG2. For interpretations of Agassiz soil in BKG2, and of Sheep Creek soil in BLG2, refer to their respective series.	Fair to a depth of 16 inches: gravelly silt loam.	Poor: very cobbly; excessive fines.	Good to fair: A–2 and A–4 material.	Bedrock at a depth of 28 to 40 inches; slopes of 30 to 70 percent; very cobbly.	Semipervious to pervious surface; bedrock at a depth of 28 to 40 inches; slopes of 30 to 70 percent.	Medium shear strength; susceptible to piping; semipervious; cobbly; low to medium compressibility.
Blackrock: BmB, BmC, BmD, BnD.	Fair to a depth of 39 inches: gravelly loam.	Poor to not suitable: 35 to 55 percent fines.	Fair: A–4 material.	Moderate frost-heave potential; slopes of 3 to 20 percent.	Slopes of 3 to 20 percent.	Susceptible to piping; low to medium shear strength; low to medium compressibility; semipervious.
*Bradshaw: BSG2. For interpretations of Agassiz soil, refer to the Agassiz series.	Good to a depth of 14 inches.	Fair below a depth of 14 inches: 25 to 50 percent fines.	Good to fair: A–2 and A–4 material.	Slopes of 30 to 60 percent; cobbly and very cobbly.	Slopes of 30 to 60 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
Cache: Ca	Poor: silty clay; salts; poorly drained.	Not suitable: excessive fines.	Poor: A–7 material; high water table.	Very poor embankment material; high water table; moderate frost-heave potential; subject to overflow; high plasticity.	High water table; slopes of 0 to 1 percent.	Low shear strength; high compressibility.
Cardon: Cd	Poor: silty clay.	Not suitable: excessive fines.	Poor: A–7 material.	Very poor embankment material; high water table; moderate frost-heave potential; high plasticity.	High water table; slopes of 0 to 3 percent.	Low shear strength; impervious; high compressibility.
Center Creek: CE	Good to a depth of 8 inches.	Not suitable: excessive fines.	Poor: A–6 and A–7 material.	Poor embankment material; seasonal high water table; medium plasticity.	Seasonal high water table; slopes of 1 to 3 percent.	Low to medium shear strength; semipervious; high organic-matter content in surface layer; medium compressibility; susceptible to piping.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent; bedrock at a depth of 28 to 40 inches.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 28 to 40 inches.	Severe: slopes of 30 to 70 percent; very cobbly; bedrock at a depth of 28 to 40 inches.
Not applicable	Slopes of 3 to 20 percent; moderate intake rate.	Gravelly textured; some cobblestones; slopes of 3 to 20 percent.	Gravelly textured; some cobblestones; slopes of 3 to 20 percent.	Slight to severe: slopes of 3 to 20 percent.	Slight to severe: moderate permeability; slopes of 3 to 20 percent.	Moderate to severe: moderate permeability; slopes of 3 to 20 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.
Very slow permeability; surface ponding; subject to overflow; high water table; gravity outlets difficult to obtain; silty clay.	Low available water capacity; salts; very slow intake rate; subject to overflow; high water table.	Not applicable	Not applicable	Severe: high shrink-swell potential; water table at a depth of 0 to 20 inches; poorly drained.	Severe: very slow permeability; water table at a depth of 0 to 20 inches.	Severe: high shrink-swell potential; water table at a depth of 0 to 20 inches.
Very slow permeability; high water table; silty clay.	Slow intake rate; high water table; very slow permeability.	Not applicable	Not applicable	Severe: high shrink-swell potential; somewhat poorly drained; water table at a depth of 30 to 60 inches.	Severe: very slow permeability; high water table.	Moderate: high shrink-swell potential; water table at a depth of 30 to 60 inches.
Moderately slow permeability; seasonal high water table; stratified substratum; outlets are very difficult to obtain.	Moderately slow intake rate; seasonal high water table.	Seasonal high water table; moderately slow permeability.	Seasonal high water table.	Severe: seasonal high water table at a depth of 20 to 40 inches; somewhat poorly drained.	Severe: seasonal high water table at a depth of 20 to 40 inches; moderately slow permeability.	Moderate: moderately slow permeability; seasonal high water table.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Clegg: CFE	Good to a depth of 20 inches.	Not suitable to a depth of 20 inches; poor below a depth of 20 inches: poorly graded; excessive fines; very cobbly.	Good to fair: A–2 and A–4 material.	Substratum very cobbly; slopes of 20 to 30 percent.	Slopes of 20 to 30 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
*Cluff: CGE, CHE, CIE For interpretations of Lucky Star soil in CHE, and of the Scout soil in CIE, refer to their respective series.	Good to a depth of 10 inches; poor below a depth of 10 inches: very gravelly.	Poor: poorly graded; excessive fines; some cobblestones.	Good: dominantly A–2 material.	Slopes of 6 to 30 percent.	Slopes of 6 to 30 percent.	Medium to high shear strength; semipervious to impervious; low compressibility.
Collett: Ck	Fair to a depth of 12 inches, except for water table.	Not suitable: excessive fines.	Poor; A–6 and A–7 material.	Poor embankment material; high water table; moderate frost-heave potential; medium plasticity.	High water table; slopes of 0 to 3 percent.	Low to medium shear strength; impervious; medium compressibility.
Collinston: ClA, CmC, CmD, CmE2.	Good to a depth of 15 inches.	Not suitable: excessive fines.	Fair: A–4 material.	Moderate frost-heave potential; moderately erodible in cuts and fills; strongly undulating topography; slopes of as much as 30 percent.	Semipervious; subject to piping; slopes of as much as 30 percent.	Low to medium shear strength; susceptible to piping; semipervious.
Crookston: CoA, CoB, CoC	Good	Not suitable: excessive fines.	Fair: A–4 material.	Moderate frost-heave potential; slopes of 0 to 10 percent.	Semipervious; subject to piping.	Low to medium shear strength; susceptible to piping; semipervious; medium compressibility.
Crowshaw: CrB, CrC, CrD	Fair: gravelly loam.	Poor to not suitable: 35 to 55 percent fines.	Fair: A–4 material.	Low to moderate frost-heave potential; slopes of 3 to 20 percent.	Slopes of 3 to 20 percent.	Low to medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
*Curtis Creek: CSE, CSG For interpretations of Goring soil, refer to the Goring series.	Good to a depth of 12 inches.	Not suitable: excessive fines.	Fair: A–4 material.	Bedrock at a depth of 13 to 20 inches; slopes of 10 to 60 percent.	Bedrock at a depth of 13 to 20 inches; slopes of 10 to 60 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 20 to 30 percent.	Severe: slopes of 20 to 30 percent.	Severe: slopes of 20 to 30 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 6 to 30 percent.	Moderate to severe: slopes of 6 to 30 percent.	Severe: very gravelly; slopes of 6 to 30 percent.
Slow permeability; high water table.	Slow intake rate; high water table.	Not applicable	Not applicable	Severe: water table at a depth of 20 to 36 inches; high shrink-swell potential; somewhat poorly drained.	Severe: water table at a depth of 20 to 36 inches; slow permeability.	Moderate: high organic-matter content; water table at a depth of 20 to 30 inches.
Not applicable	Moderate intake rate; slopes of 6 to more than 20 percent; generally not suitable for irrigation.	Slopes of 1 to 30 percent.	Slopes of 1 to 30 percent.	Slight to severe: slopes of 1 to 30 percent.	Moderate to severe: slopes of 1 to 30 percent; moderate permeability.	Moderate to severe: slopes of 1 to 30 percent; moderate permeability.
Not applicable	Moderate intake rate; slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent.	Moderate to severe: moderate permeability; slopes of 0 to 10 percent.	Moderate to severe: slopes of 0 to 10 percent; moderate permeability.
Not applicable	Moderate intake rate; slopes of 3 to 20 percent.	Slopes of 3 to 20 percent.	Slopes of 3 to 20 percent.	Slight to severe: slopes of 3 to 20 percent.	Moderate to severe: slopes of 3 to 20 percent.	Moderate to severe: slopes of 3 to 20 percent; moderate permeability.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to very severe: slopes of 10 to 60 percent; bedrock at a depth of 13 to 20 inches.	Severe: bedrock at a depth of 13 to 20 inches; slopes of 10 to 60 percent.	Severe: bedrock at a depth of 13 to 20 inches; slopes of 10 to 60 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Dagor: DaC, DaD	Good to a depth of 34 inches.	Not suitable: excessive fines.	Fair: A–4 material.	Moderate frost-heave potential; poor embankment material; slopes of 4 to 20 percent; high organic-matter content in upper 24 inches.	Slopes of 4 to 20 percent.	Low to medium shear strength; susceptible to piping; semipervious; medium compressibility.
*Dateman: DEG, DHG For interpretations of Bradshaw soil in DHG, refer to the Bradshaw series.	Poor: cobbly.	Poor: cobbly.	Good to fair: A–2 and A–4 material.	Bedrock at a depth of 26 to 40 inches; slopes of 40 to 70 percent; cobbly.	Semipervious to pervious surface layer; bedrock at a depth of 27 to 40 inches.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
*Datwyler: DLG, DNG For interpretations of Elzinga and Maughan soils in DNG, refer to their respective series.	Poor: cobbly.	Poor: cobbly; clayey fines.	Good to poor: A–2 and A–6 material.	Bedrock at a depth of 32 to 40 inches; slopes of 30 to 60 percent; cobbly; fines are plastic.	Bedrock at a depth of 32 to 40 inches; slopes of 30 to 60 percent.	Medium to high shear strength; impervious; low compressibility.
*Despain: DPG, DSG For interpretations of Bickmore soil in DPG, and of Lucky Star soil in DSG, refer to their respective series.	Fair to a depth of 16 inches: gravelly; some cobblestones.	Poor to not suitable: 25 to 60 percent fines.	Fair to good: A–2 and A–4 material.	Slopes of 20 to 70 percent; some cobblestones.	Slopes of 20 to 70 percent.	Medium shear strength; semipervious; low to medium compressibility.
*Elwood: EDG, EGE, EME, EMG. For interpretations of Agassiz soil in EGE, and of Mult soil in EME and EMG, refer to their respective series.	Good to a depth of 11 inches.	Poor to not suitable: 25 to 60 percent fines.	Good to fair: A–2 and A–4 material.	Bedrock at a depth of 20 to 40 inches; slopes of 10 to 60 percent; cobbly.	Bedrock at a depth of 20 to 40 inches; slopes of 10 to 60 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
*Elzinga Mapped only with soils of the Datwyler and Hoskin series.	Good to a depth of 22 inches.	Not suitable: cobbly; excessive fines.	Good to fair: A–4 and A–2 material.	Bedrock at a depth of 60 inches or more; slopes of 10 to 60 percent; cobbly.	Slopes of 10 to 60 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
Fitzgerald: FGD	Poor: very gravelly; cobbly and stony.	Poor: stony and cobbly; poorly graded.	Good to fair: A–2 and A–4 material.	Cobbly and stony; slopes of 10 to 20 percent.	Slopes of 10 to 20 percent.	Medium to high shear strength; susceptible to piping; semipervious; low compressibility.
Flygare: FLD	Good in some areas to a depth of 27 inches; poor in some areas: cobbly.	Poor to not suitable: excessive fines; cobbly.	Good to fair: A–4 and A–2 material.	Cobbly; slopes of 3 to 20 percent; high organic-matter content in upper 27 inches.	Slopes of 3 to 20 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Moderate intake rate; slopes of 4 to 20 percent.	Slopes of 4 to 20 percent.	Slopes of 4 to 20 percent.	Slight to severe: slopes of 4 to 20 percent.	Moderate to severe: slopes of 4 to 20 percent.	Moderate to severe: slopes of 4 to 20 percent; moderate permeability.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 40 to 70 percent.	Severe: slopes of 40 to 70 percent.	Severe: slopes of 40 to 70 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 20 to 70 percent.	Severe: slopes of 20 to 70 percent.	Severe: slopes of 20 to 70 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: bedrock at a depth of 20 to 40 inches; slopes of 10 to 60 percent.	Severe: slopes of 10 to 60 percent; bedrock at a depth of 20 to 40 inches.	Severe: slopes of 10 to 60 percent; bedrock at a depth of 20 to 40 inches.
Not applicable	Not applicable	Slopes of 10 to 60 percent.	Slopes of 10 to 60 percent.	Moderate to severe: slopes of 10 to 60 percent.	Severe: slopes of 10 to 60 percent.	Severe: slopes of 10 to 60 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate: slopes of 10 to 20 percent.	Severe: slopes of 10 to 20 percent.	Severe: slopes of 10 to 20 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Slight to severe: slopes of 3 to 20 percent.	Slight to severe: slopes of 3 to 20 percent.	Moderate to severe: slopes of 3 to 20 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Foxol: FOG	Poor: gravelly; cobbly.	Poor: 20 to 50 percent fines.	Fair to good: A–2 and A–4 material.	Bedrock at a depth of 14 to 20 inches; slopes of 30 to 60 percent; some cobblestones.	Bedrock at a depth of 14 to 20 inches; slopes of 30 to 60 percent.	Medium to high shear strength; susceptible to piping; semipervious; low compressibility.
*Goring: GGE, GOE2 For interpretations of Obray soil in GOE2, refer to the Obray series.	Good to a depth of 7 inches; not suitable below a depth of 7 inches.	Not suitable: excessive fines.	Poor: A–7 material.	Poor embankment material; slopes of 3 to 60 percent; high plasticity.	Slopes of 3 to 60 percent.	Low shear strength; high compressibility; impervious.
Gravel pit: Gp. Onsite investigation required.						
Green Canyon: GrA, GrB	Fair to a depth of 16 inches; not suitable below a depth of 16 inches: gravelly.	Poor below a depth of 16 inches: 10 to 25 percent fines.	Fair to good: A–1 and A–4 material.	Slopes of 0 to 7 percent.	Slopes of 0 to to 7 percent.	Medium to high shear strength; susceptible to piping; low compressibility; semipervious to pervious.
Greenson: GsA, GsB, GsC, GuA, GvA.	Good	Not suitable: excessive fines.	Fair: A–4 material.	Fair to poor embankment material; high water table; high frost-heave potential; slightly undulating topography.	High water table; slopes of 0 to 10 percent.	Low to medium shear strength; susceptible to piping; semipervious; medium compressibility.
Hendricks: HdA, HdB, HdC, HdD.	Good to a depth of 15 inches; fair below a depth of 15 inches.	Not suitable: excessive fines.	Fair to poor: A–4 and A–6 material.	Fair embankment material; high frost-heave potential; slopes of 1 to 20 percent; medium plasticity.	Slopes of 1 to 20 percent.	Impervious to semipervious; low to medium shear strength; medium compressibility.
Hiibner: HeC, HeD, HeE, HfE.	Poor: extemely stony and gravelly.	Not suitable: extremely stony and cobbly.	Poor: extremely stony and cobbly; mostly A–6 material.	Some cobblestones and stones; poor embankment material; slopes of 1 to 30 percent; high plasticity.	Slopes of 1 to 30 percent.	Medium to high shear strength; low compressibility.
*Hillfield: HgE2, HhE2 For interpretations of Timpanogos soil in HhE2, refer to the Timpanogos series.	Good	Not suitable: excessive fines.	Fair: A–4 material.	High frost-heave potential; eroded on steeper slopes; slopes of 10 to 30 percent.	Slopes of 10 to 30 percent.	Susceptible to piping; semipervious; low to medium shear strength; low to medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 60 percent; bedrock at a depth of 14 to 20 inches.	Severe: slopes of 30 to 60 percent; bedrock at a depth of 14 to 20 inches.	Severe: slopes of 30 to 60 percent; bedrock at a depth of 14 to 20 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: high shrink-swell potential; slopes of 3 to 60 percent.	Severe: slopes of 3 to 60 percent; slow permeability.	Moderate to severe: slopes of 3 to 60 percent.
Not applicable	Moderate intake rate; low available water capacity; very gravelly below a depth of 16 inches.	Gravelly; moderate to rapid permeability.	Low available water capacity; very gravelly below a depth of 16 inches.	Slight	Slight	Severe: rapid permeability.
Moderate permeability; high water table.	Moderate intake rate; slopes of 0 to 10 percent.	High water table in some areas.	Slopes of 0 to 10 percent.	Moderate: water table at a depth of 30 to 40 inches; moderate shrink-swell potential.	Severe: water table at a depth of 30 to 40 inches.	Moderate: moderate permeability; water table at a depth of 30 to 40 inches.
Not applicable	Moderate intake rate; slopes of 1 to 20 percent.	Slopes of 1 to 20 percent.	Slopes of 1 to 20 percent.	Moderate to severe: slopes of 1 to 20 percent; moderate shrink-swell potential.	Moderate to severe: slopes of 1 to 20 percent; moderate permeability.	Moderate to severe: slopes of 1 to 20 percent; moderate permeability.
Not applicable	Moderately slow to slow intake rate; slopes of 1 to 30 percent.	Slow permeability; fine texture; cobblestones and stones; slopes of 1 to 30 percent.	Fine textured; cobblestones and stones; slopes of 1 to 30 percent.	Moderate to severe: moderate shrink-swell potential; slopes of 1 to 30 percent.	Severe: slow permeability; slopes of 1 to 30 percent.	Severe: high in stone fragments; slopes of 1 to 30 percent.
Not applicable	Moderate intake rate; slopes of 10 to 30 percent.	Slopes of 10 to 30 percent.	Slopes of 10 to 30 percent.	Moderate to severe: slopes of 10 to 30 percent.	Severe: slopes of 10 to 30 percent.	Severe: slopes of 10 to 30 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Hoskin: HIB, HKG2, HLG2, HMG2, HNG, HOG2, HSG2. For interpretations of Datwyler soil in HGL2, of Elzinga soil in HMG2, of Scave soil in HNG, of Scout soil in HOG2, and of Smarts soil in HSG2, refer to their respective series.	Poor: gravelly; cobbly.	Poor: very cobbly; 15 to 40 percent fines.	Good to fair: A-2 and A-4 material.	Bedrock at a depth of 24 to 40 inches; slopes of 30 to 70 percent; very cobbly.	Bedrock at a depth of 24 to 40 inches; slopes of 30 to 70 percent.	Medium to high shear strength; susceptible to piping; pervious to semipervious.
Hyrum: HuC, HuE, HyC	Fair to a depth of 18 inches: gravelly; cobblestones; poor below a depth of 18 inches.	Fair to poor below a depth of 18 inches: 20 to 35 percent fines; very cobbly.	Fair to good: A-1, A-2, and A-4 material.	Very cobbly; slopes of 4 to 25 percent.	Slopes of 4 to 25 percent.	Pervious to semipervious; medium to high shear strength; low compressibility.
*Jordon: Jo, Jr For interpretations of Lasil soil in Jr, refer to the Lasil series.	Poor: salts; silty clay.	Not suitable: excessive fines.	Poor: A-7 material.	Very poor embankment material; seasonal high water table; moderate frost-heave potential; high plasticity.	Seasonal high water table; slopes of 0 to 1 percent.	High compressibility; low shear strength; impervious.
Kidman: KdA, KdD, KfA, KfB, KfC.	Good	Fair to not suited: 15 to 50 percent fines.	Fair to good: A-4, A-2, and A-1 material.	Water table at a depth of 40 inches to more than 60 inches; moderate frost-heave potential.	Fluctuating high water table.	Susceptible to piping; pervious to semipervious; medium shear strength; low compressibility.
*Kirkham: Ks, Kt For interpretations of Shay soil, refer to the Shay series.	Good to a depth of 9 inches; fair to a depth of 23 inches.	Not suitable: excessive fines.	Fair to poor: A-4 and A-7 material.	Seasonal high water table; high frost-heave potential; subject to flooding.	Seasonal high water table; slopes of 0 to 1 percent.	Impervious to semipervious; low to medium shear strength; medium compressibility.
Lakewin: La	Poor: gravelly coarse sandy loam.	Fair to good below a depth of 18 inches: 10 to 30 percent fines.	Good: A-1 and A-2 material.	Good embankment material.	Slopes of 0 to 3 percent.	Pervious; high shear strength; low compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 24 to 40 inches.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 24 to 40 inches.
Not applicable	Moderately rapid intake rate; slopes of 4 to 25 percent.	Very cobbly; moderate permeability; slopes of 4 to 25 percent.	Cobbly; slopes of 4 to 25 percent.	Moderate to severe: slopes of 4 to 25 percent.	Moderate to severe: slopes of 4 to 25 percent; moderate permeability.	Severe: slopes of 4 to 25 percent; moderate permeability.
Slow permeability; seasonal high water table.	Slow intake rate; seasonal high water table; salt and alkali.	Not applicable	Not applicable	Severe: water table at a depth of 30 to 48 inches; high shrink-swell potential; somewhat poorly drained.	Severe: slow permeability; water table at a depth of 30 to 48 inches.	Moderate: water table at a depth of 30 to 48 inches.
Moderate permeability; water table at a depth of 40 inches to more than 60 inches; ditchbanks are unstable and slough rapidly.	Moderately rapid intake rate; water table at a depth of 40 inches to more than 60 inches; slopes of 0 to 15 percent.	Slopes of 0 to 15 percent.	Slopes of 0 to 15 percent.	Slight to moderate: slopes of 0 to 15 percent.	Moderate to severe: slopes of 0 to 15 percent; water table at a depth of 40 inches to more than 60 inches.	Severe: slopes of 0 to 15 percent; moderately rapid permeability.
Moderately slow permeability; seasonal high water table; subject to flooding; gravity outlets difficult to obtain; stratified substratum in places.	Moderately slow intake rate; seasonal high water table; subject to flooding.	Not applicable	Not applicable	Severe: seasonal high water table at a depth of 30 to 50 inches; somewhat poorly drained.	Severe: moderately slow permeability; water table at a depth of 30 to 50 inches.	Moderate: seasonal high water table at a depth of 30 to 50 inches.
Not applicable	Rapid intake rate; low available water capacity; best suited to sprinkler irrigation.	Rapid permeability; sandy.	Low available water capacity; sandy.	Slight	Slight: may contaminate ground water.	Severe: rapid permeability.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*LaPlatta: LCG, LGE For interpretations of Obray soil in LGE; refer to the Obray series.	Fair to a depth of 8 inches: silty clay loam.	Not suitable: excessive fines.	Poor: A-6 and A-7 material.	Poor embankment material; slopes of 10 to 50 percent; high plasticity; high content of organic matter in upper 8 inches.	Slopes of 10 to 50 percent.	Impervious; medium to high compressibility; low to medium shear strength.
*Lasil Mapped only with soils of the Jordan series.	Fair to a depth of 12 inches; poor below a depth of 12 inches: severe salinity; strongly alkali.	Not suitable	Poor: high water table; fair shear strength; medium compressibility; fair compaction.	Poor embankment material; high water table; fair bearing capacity; high frost-heave potential; high plasticity.	High water table; slopes of 0 to 3 percent.	Impervious; low shear strength; high compressibility.
Layton: Lh	Fair to a depth of 40 inches.	Fair to good: 10 to 25 percent fines.	Good: A-2 material.	Water table at a depth of 40 to 60 inches.	Slopes of 0 to 1 percent.	Medium shear strength; susceptible to piping; pervious; low compressibility.
*Leatham: LMG2 For interpretations of Barfuss soil, refer to the Barfuss series.	Good	Not suitable: excessive fines.	Fair to poor: A-4 and A-6 material.	Fair embankment material; high frost-heave potential; slopes of 30 to 50 percent.	Slopes of 30 to 50 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.
Lewiston: Ln, Lo	Fair to a depth of 12 inches; poor below a depth of 12 inches: strongly alkali.	Fair to not suitable: 15 to 60 percent fines; no gravel.	Fair to good: A-2 and A-4 material.	High water table; slopes of 0 to 3 percent.	High water table; slopes of 0 to 3 percent.	Low to medium shear strength; susceptible to piping; pervious to semipervious; low to medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Slopes of 10 to 50 percent; moderate to moderately slow intake rate.	Slopes of 10 to 50 percent.	Slopes of 10 to 50 percent.	Severe: high shrink-swell potential; slopes of 10 to 50 percent.	Severe: moderately slow permeability; slopes of 10 to 50 percent.	Severe: slopes of 10 to 50 percent.
Slow to moderately slow permeability; high water table.	Moderately slow intake rate; moderate to severe salinity; high water table; reclamation and drainage needed.	Not applicable	Not applicable	Severe: water table at a depth of 32 to 40 inches; high shrink-swell potential; somewhat poorly drained.	Severe: water table at a depth of 32 to 40 inches; slow permeability.	Moderate: moderately fine texture.
Rapid permeability; water table at a depth of 40 to 60 inches; ditchbanks and trenches are unstable and slough readily.	Rapid intake rate; moderate available water capacity; water table at a depth of 40 to 60 inches.	Not applicable	Not applicable	Moderate: water table at a depth of 40 to 60 inches.	Moderate: water table at a depth of 40 to 60 inches.	Severe: rapid permeability.
Not applicable	Slopes of 30 to 50 percent.	Slopes of 30 to 50 percent.	Slopes of 30 to 50 percent.	Severe: slopes of 30 to 50 percent.	Severe: slopes of 30 to 50 percent.	Severe: slopes of 30 to 50 percent.
Moderately rapid permeability; fluctuating water table; ditchbanks and trenches are generally unstable and slough readily; gravity outlets are difficult to obtain in some areas.	Moderate intake rate; none to moderate salinity; alkali affected; fluctuating water table.	Not applicable	Not applicable	Moderate to severe: water table at a depth of 30 to 40 inches where soil is drained, 10 to 30 inches where soil is undrained; somewhat poorly drained.	Moderate to severe: water table at a depth of 30 to 40 inches where soil is drained, 10 to 30 inches where soil is undrained.	Severe: rapid permeability in substratum.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
					Farm ponds	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area	Embankment
Logan: Lr	Fair to a depth of 13 inches: high water table; high content of organic matter.	Not suitable: excessive fines.	Poor: A–7 material.	High content of organic matter to a depth of 13 inches; very poor embankment material; fluctuating high water table; moderate frost-heave potential; high plasticity.	Fluctuating high water table; slopes of 0 to 3 percent.	Low shear strength; impervious; high compressibility.
*Lucky Star: LSE, LTG, LUE, LVE, LWE, LXE. For interpretations of Goring soil in LUE, of Hoskin soil in LVE, of Red Spur soil in LWE, and of Scout soil in LXE, refer to their respective series.	Fair to a depth of 13 inches; poor at depths between 13 inches and 35 inches: stony and cobbly.	Poor to not suitable: excessive fines; cobbly.	Fair: A–4 material.	Fair embankment material; cobbly; slopes of 6 to 60 percent; high content of organic matter in upper 13 inches.	Slopes of 6 to 60 percent.	Medium to high shear strength; susceptible to piping; semipervious to pervious; low compressibility.
*Maughan: MAG. For interpretations of Datwyler soil, refer to the Datwyler series.	Good to a depth of 25 inches.	Not suitable: excessive fines.	Fair to poor: A–4, A–6, and A–7 material.	Poor embankment material; fines are plastic; cobblestones in substratum; high frost-heave potential; slopes of 30 to 60 percent; high organic-matter content in upper 25 inches.	Slopes of 30 to 60 percent.	Low to medium shear strength; substratum impervious; medium compressibility.
*McMurdie: McA, McB, McC, MdE2. For interpretations of Hillfield soil in MdE2, refer to the Hillfield series.	Fair to a depth of 14 inches; not suitable below a depth of 14 inches.	Not suitable: excessive fines.	Poor: A–6 and A–7 material.	Poor embankment material; high frost-heave potential; slopes of 0 to 20 percent; high plasticity.	Slopes of 0 to 20 percent.	Low shear strength; impervious; high compressibility.
*Mendon: MeA, MeB, MeC, MfB, MfE2. For interpretations of Collinston soil in MfB and MfE2, refer to the Collinston series.	Good to a depth of 9 inches; fair between depths of 9 inches and 24 inches.	Not suitable: excessive fines.	Poor: A–6 material.	Fair embankment material; moderate frost-heave potential; moderately erodible; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Semipervious to impervious; low to medium shear strength; medium compressibility
*Middle. Mapped only with soils of the Richmond series.	Poor: very cobbly.	Poor: very cobbly; 25 to 40 percent fines.	Good to fair: A–2 and A–4 material.	Bedrock at a depth of 24 to 40 inches; slopes of 30 to 70 percent.	Bedrock at a depth of 24 to 40 inches; slopes of 30 to 70 percent.	Medium to high shear strength; semipervious to pervious; low compressibility; susceptible to piping.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Slow permeability; fluctuating water table, ponded in some areas; gravity outlets are difficult to obtain; stratified substratum.	Moderately slow intake rate; fluctuating water table; high content of organic matter in some areas.	Not applicable	Not applicable	Severe: water table at a depth of 0 to 40 inches; high shrink-swell potential; poorly and very poorly drained.	Severe: water table at a depth of 0 to 40 inches; slow permeability.	Moderate to severe: high organic-matter content; water table at a depth of 0 to 40 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 6 to 60 percent.	Moderate to severe: slopes of 6 to 60 percent.	Severe: slopes of 6 to 60 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.
Not applicable	Moderately slow intake rate; slopes of 0 to 20 percent.	Moderately slow permeability; fine-textured subsoil; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Severe: high shrink-swell potential; slopes of 0 to 20 percent.	Severe: moderately slow permeability; slopes of 0 to 20 percent.	Moderate to severe: slopes of 0 to 20 percent.
Not applicable	Moderately slow to moderate intake rate; slopes of 0 to 20 percent.	Moderately slow permeability; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Moderate to severe: moderate shrink-swell potential; slopes of 0 to 20 percent.	Severe: moderately slow permeability; slopes of 0 to 20 percent.	Moderate to severe: moderately slow permeability; slopes of 0 to 20 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent; bedrock at a depth of 24 to 40 inches.	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Millville: MlA, MlB	Fair: very strongly calcareous.	Not suitable: excessive fines.	Fair: A-4 material.	Occasional high water table; high frost-heave potential.	High water table in some areas; slopes of 0 to 6 percent.	Low to medium shear strength; susceptible to piping; semipervious; medium compressibility.
Mixed alluvial land: Mm. Onsite investigation required.						
*Mult: MNE, MNG2, MSE. For interpretations of Agassiz soil in MNE and MNG2, and of Lucky Star soil in MSE, refer to their respective series.	Good to a depth of 14 inches; fair below a depth of 14 inches.	Not suitable: excessive fines.	Fair to poor: A-4 and A-6 material.	Bedrock at a depth of 22 to 40 inches; slopes of 6 to 50 percent.	Bedrock at a depth of 22 to 40 inches; slopes of 6 to 50 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.
*Munk: MoG2. For interpretations of Blackrock soil, refer to the Blackrock series.	Fair to poor: very gravelly.	Fair to poor: 10 to 50 percent fines; 20 to 50 percent gravel.	Fair to good: A-1, A-2, and A-4 material.	Partially consolidated below a depth of 20 to 40 inches; slopes of 30 to 70 percent.	Partially consolidated below a depth of 20 to 40 inches; slopes of 30 to 70 percent.	Medium to high shear strength; pervious to semipervious; low compressibility; susceptible to piping.
Nebeker: NbB, NbC, NbE	Good to a depth of 12 inches.	Not suitable: excessive fines.	Poor: A-6 and A-7 material.	Poor embankment material; high frost-heave potential; slopes of 3 to 40 percent; high plasticity.	Slopes of 3 to 40 percent.	Low to medium shear strength; impervious; high to medium compressibility.
Nibley: NcA, NcB	Poor: silty heavy clay loam.	Not suitable: excessive fines.	Poor: A-7 material.	Poor embankment material; moderately high water table; moderate frost-heave potential; high plasticity.	High water table in some areas; slopes of 0 to 6 percent.	Impervious; medium to high compressibility; low to medium shear strength.
Obray: ObB	Poor: silty clay.	Not suitable: excessive fines.	Poor: A-7 material.	Very poor embankment material; moderate frost-heave potential; slopes of as much as 20 percent; high plasticity.	Slopes of as much as 1 to 20 percent.	High compressibility; low shear strength; impervious.
Parleys: PaA, PaB, PaC	Good to a depth of 12 inches; fair between depths of 12 and 30 inches.	Not suitable: excessive fines.	Fair to poor: A-4 and A-6 material.	Fair embankment material; high frost-heave potential; slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Semipervious to impervious; low to medium shear strength; medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Moderate permeability; high water table in some areas.	Moderate intake rate; high water table in some areas.	Slopes of 0 to 6 percent.	Slopes of 0 to 6 percent.	Moderate: some areas have a water table at a depth of 40 to 50 inches.	Moderate: some areas have a water table at a depth of 40 to 50 inches; moderate permeability.	Moderate: moderate permeability.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 6 to 50 percent; bedrock at a depth of 22 to 40 inches.	Severe: slopes of 6 to 50 percent; bedrock at a depth of 22 to 40 inches.	Severe: slopes of 6 to 50 percent; bedrock at a depth of 22 to 40 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.
Not applicable	Moderately slow to moderate intake rate.	Moderately slow permeability; fine-textured subsoil; slopes of 3 to 40 percent.	Fine-textured subsoil; slopes of 3 to 40 percent.	Severe: high shrink-swell potential; slopes of 3 to 40 percent.	Severe: moderately slow permeability; slopes of 3 to 40 percent.	Moderate to severe: slopes of 3 to 40 percent.
Slow permeability; high water table in some areas; fine texture.	Slow intake rate; high water table; fine texture.	Not applicable.	Not applicable	Severe: water table at a depth of 30 to 60 inches; high shrink-swell potential; somewhat poorly drained.	Severe: water table at a depth of 30 to 60 inches; slow permeability.	Moderate: water table at a depth of 30 to 60 inches.
Not applicable	Slopes of 1 to 20 percent; high intake rate if soil is cracked, low intake rate if soil is not cracked; fine texture.	Very slow permeability; fine texture; deep cracks.	Fine texture; deep cracks; slopes of 1 to 20 percent.	Severe: high shrink-swell potential; slopes of 1 to 20 percent.	Severe: very slow permeability.	Slight to severe: slopes of 1 to 20 percent.
Not applicable	Moderate intake rate, slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Moderate: moderate shrink-swell potential; slopes of 0 to 10 percent.	Severe: moderate to slow permeability; slopes of 0 to 10 percent.	Slight to severe: slopes of 0 to 10 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
					Farm ponds	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area	Embankment
Parlo: PlA, PlB, PlC	Good to a depth of 11 inches; fair between depths of 11 and 30 inches.	Good to fair below a depth of 20 inches: 15 to 25 percent fines; 50 to 80 percent gravel.	Fair to poor to a depth of 30 inches; good below a depth of 30 inches: A–1 material.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Semipervious to impervious; medium shear stength; medium compressibility.
Payson: Pn	Poor: strongly alkali.	Not suitable: excessive fines.	Poor: A–6 and A–7 material.	Poor embankment material; seasonal high water table; moderate frost-heave potential; high plasticity.	Seasonal high water table; slopes of 0 to 1 percent.	Low shear strength; impervious; high compressibility.
*Picayune: POG2, PRG For interpretations of Agassiz soil in POG2, and of Smarts soil in PRG, refer to their respective series.	Poor: gravelly texture; cobbly.	Poor to not suitable: 35 to 65 percent fines.	Fair: A–4 material.	Slopes of 50 to 80 percent.	Slopes of 50 to 80 percent.	Low to medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
Poleline: PSG2 For interpretations of Agassiz soil, refer to the Agassiz series.	Fair to a depth of 20 inches.	Poor to not suitable: 35 to 65 percent fines; 20 to 40 percent gravel.	Fair: A–4 material.	Slopes of 30 to 70 percent.	Slopes of 30 to 70 percent.	Low to medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
Preston: PtC	Poor: fine sand.	Good to excellent for sand: 5 to 20 percent fines; no gravel.	Good: A–2 or A–3 material.	Slopes of 0 to 10 percent; fine sand.	Slopes of 0 to 10 percent.	Pervious; high shear strength; low compressibility.
Provo: Pu, Pv	Fair to a depth of 12 inches: gravelly loam; not suitable below a depth of 12 inches.	Fair for sand: 10 to 25 percent fines; fair to good for gravel: 50 to 80 percent gravel.	Good: dominantly A–1 material.	Upper 2 inches are peat; high water table; subject to flooding; slopes of 0 to 3 percent.	High water table; slopes of 0 to 3 percent.	Medium to high shear strength; semipervious to pervious; susceptible to piping; low compressibility.
Quinney: Qu	Fair to a depth of 8 inches; poor below a depth of 8 inches: strongly alkali.	Not suitable: excessive fines.	Poor to fair: A–4 and A–6 material.	Poor embankment material; moderately high water table; high frost-heave potential.	High water table; slopes of 0 to 2 percent.	Low to medium shear strength; susceptible to piping; impervious to semipervious.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Moderate intake rate; slopes of 0 to 10 percent; low available water capacity below a depth of 30 inches.	Rapid permeability below a depth of 30 inches; slopes of 1 to 10 percent.	Slopes of 0 to 10 percent; low available water capacity below a depth of 30 inches.	Moderate: moderate shrink-swell potential.	Slight: possible contamination of ground water.	Severe: rapid permeability below a depth of 30 inches.
Very slow permeability; seasonal high water table; gravity outlets difficult to obtain; fine texture.	Slow intake rate; fine texture; seasonal high water table; slight to severe salinity; strongly alkali.	Not applicable	Not applicable	Severe: high shrink-swell potential; somewhat poorly drained; water table at a depth of 30 to 50 inches.	Severe: very slow permeability; water table at a depth of 30 to 50 inches.	Moderate: seasonal high water table at a depth of 30 to 50 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 50 to 80 percent.	Severe: slopes of 50 to 80 percent.	Severe: slopes of 50 to 80 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.
Not applicable	Rapid intake rate; very low available water capacity.	Generally not suitable; very sandy texture; rapid permeability; erodible.	Generally not suitable; low available water capacity.	Slight to moderate: slopes of 0 to 10 percent.	Slight to moderate: possible contamination of ground water; slopes of 0 to 10 percent.	Severe: rapid permeability; slopes of 0 to 10 percent.
Moderate to moderately rapid permeability; high water table; trenches slough readily.	Moderate intake rate; low available water capacity in substratum; subject to flooding.	Not applicable	Not applicable	Severe: water table at a depth of 26 to 36 inches; poorly drained.	Severe: water table at a depth of 26 to 36 inches.	Severe: moderately rapid permeability below a depth of about 20 inches; water table at a depth of 26 to 36 inches.
Slow permeability; high water table.	Moderate intake rate; high water table; slight to severe salinity; strongly alkali.	Not applicable	Not applicable	Moderate: water table at a depth of 30 to 50 inches; moderate shrink-swell potential.	Severe: slow permeability below a depth of 40 inches; water table at a depth of 30 to 50 inches.	Moderate: water table at a depth of 30 to 50 inches.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Red Spur. Mapped only with soils of the Lucky Star series.	Good to a depth of 48 inches.	Poor to not suitable: 30 to 60 percent fines.	Fair: dominantly A–4 material.	Fair embankment material; slopes of 10 to 30 percent; high content of organic matter in upper 26 inches.	Slopes of 10 to 30 percent.	Low to medium shear strength; semipervious; susceptible to piping; low to medium compressibility.
*Richmond: RCG2, RDG2, REG2, RFG2, RGG2. For interpretations of Middle soil in RDG2, of Munk soil in REG2, of Nebeker soil in RFG2, and of Sterling soil in RGG2, refer to their respective series.	Poor: very stony and shallow.	Fair: 15 to 35 percent fines; 30 to 80 percent gravel.	Good: A–2 material.	Bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.	Bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.	Medium shear strength; semipervious; low to medium compressibility.
Ricks: RhA, RhB, RhC	Fair to a depth of 18 inches: gravelly loam.	Good to fair below a depth of 18 inches for sand: 5 to 25 percent fines; good for gravel: 70 to 80 percent gravel.	Good below a depth of 18 inches: A–1 material.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Medium to high shear strength; semipervious to pervious; low compressibility.
Riverwash: Rk. Onsite investigation required.						
Rockland: RO. Onsite investigation required.						
Roshe Springs: Rs	Fair to a depth of 8 inches; poor at depths between 8 and 20 inches.	Not suitable: excessive fines.	Fair: A–4 material.	Upper 2 inches are peat; poor embankment material; high water table; high frost-heave potential.	High water table; slopes of 0 to 3 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.
Rough broken land: Rt. Onsite investigation required.						
*St. Marys: SAG, SCG. For interpretations of Curtis Creek soil in SCG, refer to the Curtis Creek series.	Fair: gravelly fine sandy loam.	Fair to poor: 10 to 35 percent fines; 50 to 80 percent gravel.	Good: A–1 and A–2 material.	Slopes of 30 to 60 60 percent.	Slopes of 30 to 60 percent.	Pervious to semipervious; medium to high shear strength; low compressibility; susceptible to piping.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 10 to 30 percent; bedrock at a depth of 48 inches to more than 60 inches.	Severe: slopes of 10 to 30 percent; bedrock at a depth of 48 inches to more than 60 inches.	Severe: slopes of 10 to 30 percent; bedrock at a depth of 48 inches to more than 60 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.	Severe: bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.	Severe: bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.
Not applicable	Moderate intake rate; low available water capacity; very gravelly below a depth of 18 inches; slopes of 0 to 10 percent.	Gravelly texture; very rapid permeability below a depth of 18 inches; slopes of 0 to 10 percent.	Gravelly texture; low available water capacity below a depth of 18 inches; slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent; possible ground water contamination.	Severe: very rapid permeability below a depth of 18 inches.
Moderate permeability; high water table except where drained; outlets are difficult to obtain.	Moderate intake rate; high water table in some areas.	Not applicable	Not applicable	Severe: water table at a depth of 0 to 36 inches; poorly drained.	Severe: water table at a depth of 0 to 36 inches.	Severe: high content of organic matter; water table at a depth of 0 to 36 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent; bedrock at a depth of 40 inches to more than 60 inches.	Severe: slopes of 30 to 60 percent; bedrock at a depth of 40 inches to more than 60 inches

TABLE 4.—*Engineering*

	Suitability as a source of—			Soil features affecting—		
Soil series and map symbols	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Salt Lake: Sd, Se, Sf, Sg, Sh. For interpretations of Logan soil in Sf, of Roshe Springs soil in Sg, and of Trenton soil in Sh, refer to their respective series.	Poor: silty clay.	Not suitable: excessive fines.	Poor: A–7 material.	High content of organic matter to a depth of 6 inches; poor embankment material; fluctuating water table; moderate frost-heave potential; high plasticity.	High water table; slopes of 0 to 1 percent.	Low shear strength; high compressibility; impervious.
Scave: SIE, SKE	Good to a depth of 18 inches.	Poor: poorly graded; excessive fines; cobbly.	Fair to good: A–2 and A–4 material.	Cobbly; slopes of 10 to 30 percent; high frost-heave potential; high content of organic matter in upper 10 inches.	Slopes of 10 to 30 percent.	Medium shear strength; subject to piping; semipervious; medium compressibility.
Scout: SLG	Fair to a depth of 18 inches: gravelly loam.	Poor to good for sand: 15 to 45 percent fines; 50 to 60 percent gravel.	Fair to good: A–2 and A–4 material.	Slopes of 10 to 70 percent.	Slopes of 10 to 70 percent.	Medium to high shear strength; stable; susceptible to piping; semipervious; low compressibility.
Shay: Sm	Fair to a depth of 14 inches: silty clay loam.	Not suitable: excessive fines.	Poor: dominantly A–6 and A–7 material.	Poor embankment material; moderately high water table; high frost-heave potential; subject to flooding in spring; medium plasticity.	High water table; slopes of 0 to 1 percent.	Low to medium shear strength; medium to high compressibility; impervious to semipervious.
*Sheep Creek: SNG2, SOG2, SPG2, SRG2. For interpretations of Agassiz soil in SOG2, of Despain soil in SPG2, and of Maughan soil in SRG2, refer to their respective series.	Poor: cobbly.	Fair to poor: 15 to 50 percent fines; 40 to 80 percent gravel.	Fair to good: A–2 and A–4 material.	Bedrock at a depth of 26 to 40 inches; slopes of 30 to 70 percent; very cobbly.	Bedrock at a depth of 26 to 40 inches; slopes of 30 to 70 percent.	Medium to high shear strength; semipervious to pervious; low compressibility; susceptible to piping.
*Smarts: SSE, STG2, SUG For interpretations of Hoskin soil in STG2, and of Lucky Star and Poleline soils in SUG, refer to their respective series.	Good to a depth of 15 inches; fair between depths of 15 inches and 22 inches: gravelly; some cobblestones.	Fair to good below a depth of 22 inches: 15 to 30 percent fines; 50 to 85 percent gravel.	Fair to good: A–2 and A–4 material.	Cobbly; slopes of 10 to 70 percent; high content of organic matter in upper 22 inches.	Slopes of 10 to 70 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Very slow permeability; high water table; fine texture; gravity outlets are difficult to obtain.	Slow intake rate; high water table; large amount of organic matter on surface.	Not applicable	Not applicable	Very severe: water table at a depth of 0 to 30 inches; high shrink-swell potential; poorly and very poorly drained.	Severe: very slow permeability; water table at a depth of 0 to 30 inches.	Severe: high content of organic matter; water table at a depth of 0 to 30 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 10 to 30 percent; moderate shrink-swell potential.	Severe: slow permeability below a depth of 34 inches; slopes of 10 to 30 percent.	Severe: slopes of 10 to 30 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 10 to 70 percent.	Severe: slopes of 10 to 70 percent.	Severe: slopes of 10 to 70 percent.
Slow permeability; high water table; stratified substratum; subject to flooding; gravity outlets difficult to obtain in some areas; fine texture.	Slow intake rate; high water table; subject to flooding.	Not applicable	Not applicable	Severe: water table at a depth of 30 to 50 inches; high shrink-swell potential; somewhat poorly drained.	Severe: slow permeability; water table at a depth of 30 to 50 inches.	Moderate: water table at a depth of 30 to 50 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent; bedrock at a depth of 26 to 40 inches.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 26 to 40 inches.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 26 to 40 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 10 to 70 percent.	Severe: slopes of 10 to 70 percent.	Severe: slopes of 10 to 70 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Steed: SvA, SvB, SvC	Fair to a depth of 18 inches: gravelly loam.	Fair to good below a depth of 17 inches: 10 to 25 percent fines; 5 to 80 percent gravel.	Fair to good: A–2 and A–4 material.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Pervious to semipervious; medium to high shear strength; low compressibility; susceptible to piping.
Sterling: SwC, SwD, SwF2	Fair to a depth of 16 inches: gravelly loam.	Good to fair below a depth of 16 inches: 5 to 25 percent fines; 50 to 90 percent gravel.	Good below a depth of 16 inches: A–1 material.	Slopes of 6 to 50 percent.	Slopes of 6 to 50 percent.	Pervious; medium to high shear strength; low compressibility.
Stony alluvial land: Sy. Onsite investigation required.						
Timpanogos: TmA, TmB, TmC, TmD2, TnA.	Good	Not suitable: excessive fines.	Fair: A–4 material.	Occasional high water table; moderate frost-heave potential; slopes of 0 to 20 percent.	Occasional high water table; slopes of 0 to 20 percent.	Susceptible to piping; semipervious to impervious; low to medium shear strength; medium compressibility.
Trenton: TrA, TrB, TrC, TrD2, TtA.	Fair to a depth of 8 inches; poor below a depth of 8 inches: high water table; salts and alkali.	Not suitable: excessive fines.	Poor: A–7 material.	Poor for embankment material; high water table; moderate frost-heave potential; high plasticity; slopes of 0 to 20 percent.	High water table; slopes of 0 to 20 percent.	Impervious; high compressibility; low shear strength.
*Wheelon: WhE, WhF2, WlE2. For interpretations of Collinston soil in WlE2, refer to the Collinston series.	Poor: moderately to strongly calcareous.	Not suitable: excessive fines.	Fair: A–4 material.	High frost-heave potential; slopes of 10 to 70 percent.	Slopes of 10 to 70 percent.	Susceptible to piping; low to medium shear strength; medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Moderately rapid intake rate; low available water capacity; slopes of 0 to 10 percent.	Not applicable	Gravelly texture; low available water capacity below a depth of 17 inches; slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent; possible ground water contamination.	Severe: very rapid permeability below a depth of 17 inches.
Not applicable	Moderately rapid intake rate; low available water capacity; gravelly; slopes of 6 to 50 percent.	Very gravelly texture; rapid permeability below a depth of 16 inches; slopes of 6 to 50 percent.	Very gravelly; slopes of 6 to 50 percent.	Slight to severe: slopes of 6 to 50 percent.	Moderate to severe: slopes of 6 to 50 percent; possible ground water contamination.	Severe: slopes of 6 to 50 percent; very gravelly; rapid permeability below a depth of 16 inches.
Generally not applicable; water table at a depth of 36 to 54 inches; moderate permeability.	Moderate intake rate; high water table; needs drainage in some areas; slopes of 6 to 20 percent are best suited to sprinkler irrigation.	Moderately permeable; water table at a depth of 36 to 54 inches in some areas; slopes of 0 to 20 percent.	High water table at a depth of 36 to 54 inches in some areas; slopes of 0 to 20 percent.	Moderate to severe: water table in some areas below a depth of 36 inches; slopes of 0 to 20 percent; moderate shrink-swell potential.	Moderate to severe: water table in some areas below a depth of 36 inches; slopes of 0 to 20 percent; moderate permeability.	Moderate to severe: slopes of 0 to 20 percent; moderate permeability.
Slow permeability; high water table; fine texture.	Slow intake rate; high water table; slight to severe salinity; alkali; fine texture; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Severe: water table at a depth of 28 to 60 inches; high shrink-swell potential; slopes of 0 to 20 percent; somewhat poorly to moderately well drained.	Severe: water table at a depth of 28 to 60 inches; slow permeability; slopes of 0 to 20 percent.	Moderate to severe: slopes of 0 to 20 percent; water table at a depth of 28 to 60 inches.
Not applicable	Moderately slow intake rate; slopes of 10 to 70 percent; highly erodible.	Moderately slow permeability; slopes of 10 to 70 percent.	Slopes of 10 to 70 percent.	Moderate to severe: slopes of 10 to 70 percent; moderate shrink-swell potential; bedrock at a depth of 24 inches to more than 60 inches.	Severe: slopes of 10 to 70 percent; bedrock at a depth of 24 inches to more than 60 inches.	Severe: slopes of 10 to 70 percent; bedrock at a depth of 24 inches to more than 60 inches.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Winn: Wn, Wp For interpretations of Provo in Wp, refer to the Provo soil series.	Good	Not suitable: excessive fines.	Fair: A-4 material.	Seasonal high water table; moderate frost-heave potential; subject to spring flooding; slopes of 0 to 3 percent.	Seasonal high water table; slopes of 0 to 3 percent.	Susceptible to piping; semipervious to impervious; low to medium shear strength; medium compressibility.
Woods Cross: Wr	Poor below a depth of 8 inches; high content of organic matter; high water table; heavy silty clay loam.	Not suitable: excessive fines.	Poor: A-7 or A-6 material.	Peat and high content of organic matter in upper 8 inches; poor embankment material; high water table; high frost-heave potential; high plasticity.	High water table; slopes of 0 to 1 percent.	Low to medium shear strength; impervious to semipervious; low compressibility; susceptible to piping.
Yeates Hollow: YHE, YHG, YLE2.	Poor: extremely stony silt loam.	Poor: fine texture; stony and cobbly.	Fair to good: A-2 and A-4 material.	Stony and cobbly; rock fragments below a depth of 40 inches; fines plastic; slopes of 3 to 70 percent.	Bedrock below a depth of 40 inches; slopes of 3 to 70 percent.	Impervious; medium to high shear strength; low to medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Moderate permeability; seasonal high water table; stratified substratum; subject to flooding; gravity outlets difficult to obtain in some areas.	Moderate intake rate; seasonal high water table; seasonal flooding.	Not applicable	Not applicable	Moderate: water table at a depth of 30 to 50 inches; moderate shrink-swell potential; somewhat poorly drained.	Moderate: water table at a depth of 30 to 50 inches.	Moderate: moderate permeability; water table at a depth of 30 to 50 inches.
Slow permeability; high water table; stratified substratum; fine texture.	Moderately slow intake rate; high water table; fine texture; organic matter on surface in some areas.	Not applicable	Not applicable	Severe: high water table at a depth of 10 to 30 inches; high shrink-swell potential; poorly drained.	Severe: high water table at a depth of 10 to 30 inches; slow permeability.	Severe: high content of organic matter; high water table at a depth of 10 to 30 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 3 to 70 percent; moderate shrink-swell potential; bedrock at a depth of 40 inches to more than 60 inches.	Severe: slopes of 3 to 70 percent; slow permeability; bedrock at a depth of 40 inches to more than 60 inches.	Severe: slopes of 3 to 70 percent; bedrock at a depth of 40 inches to more than 60 inches.

TABLE 5.—*Engineering*

[Tests were performed by U.S. Department of Commerce, Bureau of Public Roads, in accordance

Soil name and location	Depth from surface	Mechanical analysis [1]					
		Percentage passing sieve—					
		1½-inch	1-inch	¾-inch	⅜-inch	No. 4 (4.7 mm)	No. 10 (2.0 mm)
	Inches						
Lewiston fine sandy loam: 850 feet N. and 1,100 feet E. of SW. corner of NE¼ sec. 18, T. 14 N., R. 1 E. (Modal)	0–10	--------	--------	--------	--------	--------	100
	13–22	--------	--------	--------	--------	--------	100
	32–50	--------	--------	--------	--------	--------	100
Logan silty clay loam: 1,100 feet S. and 500 feet E. of NW. corner of NE¼ sec. 16, T. 11 N., R. 1 W. (Modal)	0–13	--------	--------	--------	--------	--------	--------
	13–26	--------	--------	--------	--------	--------	100
	26–45	--------	--------	--------	--------	--------	--------
Mendon silt loam: 700 feet N. and 40 feet W. of SE. corner of SW¼ sec. 1, T. 13 N., R. 2 W. (Modal)	0–7	--------	--------	--------	--------	--------	100
	7–24	--------	--------	--------	--------	--------	100
	28–34	--------	--------	--------	--------	--------	100
	34–40	100	99	99	98	97	96
Nebeker silt loam: 20 feet N. and 100 feet W. of SE. corner of NW¼ sec. 14, T. 10 N., R. 1 E. (Modal)	0–8	[4] 99	99	99	99	98	97
	26–55	100	98	97	96	94	92
	55–70	100	99	97	89	82	78
Ricks gravelly loam: 700 feet N. and 200 feet E. of SW. corner of sec. 2, T. 10 N., R. 1 E. (Modal)	0–4	[4] 99	97	95	91	88	86
	4–9	100	98	96	92	90	87
	18–24	[5] 81	68	60	43	31	24
Trenton silty clay loam: 200 feet N. and 600 feet W. of SE. corner of NW¼ sec. 29, T. 14 N., R. 1 E. (Modal)	0–8	--------	--------	--------	--------	--------	--------
	8–15	--------	--------	--------	--------	--------	--------
	26–34	--------	--------	--------	--------	--------	--------
	34–60	--------	--------	--------	--------	--------	--------

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[1] Mechanical analysis according to AASHO Designation: T 88–57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

test data

with standard procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [1]—Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Con.			Percentage smaller than—						AASHO [1]	Unified [2]
No. 40 (0.42 mm)	No. 60 (0.25 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm				
99	89	25	23	17	11	9	[3] NP	[3] NP	A-2-4(0)	SM
99	90	26	23	20	17	14	NP	NP	A-2-4(0)	SM
98	88	17	14	12	9	8	NP	NP	A-2-4(0)	SM
------------	100	98	96	83	61	45	61	23	A-7-5(17)	MH
99	99	96	93	82	58	43	46	20	A-7-6(13)	ML-CL
------------	----------	100	99	94	79	67	58	30	A-7-6(20)	CH
99	95	85	81	60	36	27	28	8	A-4(8)	CL
99	98	94	91	73	50	40	44	21	A-7-6(13)	CL
95	91	82	76	57	38	29	37	16	A-6(10)	CL
86	81	68	62	47	33	26	39	17	A-6(9)	CL
95	94	89	84	58	32	23	28	7	A-4(8)	ML-CL
88	86	81	79	70	60	55	71	40	A-7-5(20)	CH
72	71	55	48	34	22	20	31	13	A-6(5)	CL
81	78	64	58	36	21	15	26	7	A-4(6)	ML-CL
81	78	64	56	36	21	16	28	10	A-4(6)	CL
17	14	10	8	6	3	2	NP	NP	A-1-a(0)	GP-GM
------------	100	99	98	80	48	32	34	13	A-6(9)	CL
------------	100	99	99	92	73	59	63	35	A-7-6(20)	CH
------------	----------	----------	100	98	78	58	58	34	A-7-6(20)	CH
------------	----------	----------	100	99	84	64	65	40	A-7-6(20)	CH

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[2] SCS and BPR have agreed to consider that all soils having plasticity indexes within two points of A-line are to be given a borderline classification. An example of a borderline classification obtained by this use is ML-CL.

[3] Nonplastic.

[4] 100 percent passed the 2-inch sieve.

[5] 88 percent passed the 2-inch sieve, and 100 percent passed the 3-inch sieve.

Agricultural scientists classify soil texture according to the system of the United States Department of Agriculture. Soil material smaller than 2.0 millimeters in diameter is classified in three size fractions as clay, silt, or sand. The percentages of the three size fractions determine the textural classification of the soil material.

The estimated percentage of soil that passes through sieves Nos. 4, 10, and 200 reflects the normal range for a soil series. Most soils within the series are within the range given, but the grain size of any soil varies considerably. Therefore, all samples of a specific soil may not be within the range and the engineering classification may vary from that shown.

Estimates of permeability are for the soil in place. They are based on the structure, texture, and porosity of the soil material and on field observations.

The available water capacity, given in inches per inch of soil, is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point.

Reaction gives the intensity of acidity or alkalinity of the soil, expressed in pH values. A pH of 7.0 is neutral. A lower value indicates acidity, and a higher value indicates alkalinity. The pH value is an indication of the corrosiveness of the soil solution to pipelines and other structures placed in the ground.

Salinity affects the suitability of a soil for crops, its stability when used as a construction material, and its corrosiveness to other materials.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. In general, soils that have a high shrink-swell potential present hazards to engineering structures constructed in, on, or with such material.

Engineering Interpretations

Table 4 provides suitability ratings of soils as a source of topsoil, sand, gravel, and road fill; describes soil features that affect stated engineering practices; and rates soils for their limitations in use as foundations of low buildings, for septic tank filter fields, and for sewage lagoons. Interpretations are based on test data and on field experience with soils in the survey area and with similar soils.

Soils are rated poor or fair as a source of topsoil if they are eroded, are low in content of organic matter or natural fertility, or have a heavy and sticky surface layer that is difficult to handle or till. Soils rated suitable as sources of sand or gravel may require extensive exploration to find material that meets specific requirements.

The soils in the survey area have been rated on the degree and dominant kind of limitation that affects their use as foundations for low-rise buildings, septic tank filter fields, and sewage lagoons. Ratings have meanings as follows:

Slight means that the soil has a few limitations that are easily overcome.

Moderate means that the soil has limitations that need to be recognized. The limitations can be overcome by proper planning, careful design, and good management.

Severe means that the soil limitations are severe enough to make the use of the soil questionable. Careful planning and above-average management are required.

Very severe means that the soil is not suited to the intended use and that extreme measures are needed to overcome limitations.

The ratings are based only on soil properties. The main properties that were considered in rating the soils are drainage, height of the water table, depth of soil, texture, kind of parent material, kind of clay, permeability, salt and alkali content, degree of slope, and stoniness. Other factors that can be important in the selection of an area for a specific use were not considered. The ratings are general and should not be used as a substitute for detailed investigations at the site proposed for development. The soil property or quality that is most restrictive to the stated use determined the rating. Ratings apply to soil material to a depth of 5 feet unless otherwise stated.

The selection and use of soils as foundations for buildings of 3 stories or less is determined mainly by soil texture, permeability, drainage, height of the water table, content of salts and alkali, shrink-swell potential, and slope. The foundation of a building transmits the weight of the structure onto the natural undisturbed soils.

The Unified soil classification system has been used to evaluate the soils in terms of their bearing capacity, compressibility, and shear strength. The density and consistency of a given soil vary, and individual site investigations will need to be made. Ratings are made with the assumption that noncohesive soils have a loose to medium relative density and cohesive soils have a soft to medium consistence. Although slope is not actually a factor that affects the foundation, it presents problems in construction and is, therefore, considered in these ratings. Special design for buildings and construction methods are needed on steep soils, but some areas of these steep soils have a definite esthetic advantage as they occur in areas where the view is unobstructed. The substratum of the soil generally provides the base for foundations and, therefore, is the soil material which is rated for foundations. Soils that have bedrock or a hardpan within a depth of 60 inches have slight limitations unless basements or underground utilities are planned.

The effectiveness of a septic tank filter is determined largely by the following soil properties: texture, permeability, depth to consolidated rock or other impervious layers, hazards of flooding or overflow, natural drainage, height of the water table, and slope.

Soils that have moderate to very rapid permeability (more than 1 inch per hour) are rated as having *slight* limitations. Soils that have a permeability at the slower end of the moderate range (about 1.0 to 0.63 inches per hour) are rated as having *moderate* limitations. Soils that have moderately slow and slow permeability (0.63 to 0.063 inches per hour) are rated as having *severe* limitations. Soils that have very slow permeability (less than 0.063 inches per hour) are rated as having *very severe* limitations. Coarse-textured soils (loamy sands, sand, and gravel) are relatively poor filtering material. These soils allow unfiltered sewage to flow long distances, and this sewage is a pollution hazard where water supplies, streams, ponds, lakes, or water courses are nearby. Coarse-textured soils that have very rapid permeability have severe to very severe limitations where there is a pollution hazard. A seasonal water table should be at least 4 feet below the surface. Well drained and moderately well drained soils that have a water table below a depth of 48 inches are rated as having a *slight* limitation. Somewhat poorly drained and moderately well drained soils that have a water table at a depth of less than 48 inches are rated as having *moderate* limitations; poorly drained and very poorly drained soils that have a shallow water table are rated as having *severe* limitations. Where bedrock or indurated hardpan is within a depth of 48 inches, the soils are rated as having *moderate* to *very severe* limitations. Soils that are frequently flooded are not suitable for septic tank filter fields. Slopes of less than 10 percent are the most desirable. Mechanical limitations in layout and construction increase with steepness of slope. The ratings listed in table 4 do not include the hazard of pollution. This factor should be evaluated through onsite investigation.

A sewage lagoon is a shallow lake used to hold sewage for bacterial decomposition. Sewage lagoons require consideration of the soil as a floor for the impounded area and as material for the dam. The requirements for the dam are the same as for other embankments designed to impound water. There must be adequate soil material available that is suitable for the structure and, when properly constructed, the lagoon must be capable of holding water with minimum seepage. The main soil properties considered in the rating for sewage lagoons are texture, permeability, depth to bedrock, organic matter, coarse fragments, and slope.

The Unified soil classification system has been used in evaluating both the reservoir site material and the embankment material. Soil material over bedrock must be thick enough so that smoothing required to obtain the specified uniformity in depth of the lagoon is practical. Moderate to high amounts of organic matter in a lagoon promote aquatic plant growth, which is detrimental.

Fragments more than 6 inches in diameter interfere with movement and compaction of the soil material in the process of smoothing the basin floor. Slopes must be relatively flat to meet the restrictions on depth (2 to 5 feet) of the liquid body in sewage lagoon.

Such factors as height of the water table, distance of the lagoon from homes, future expansion, prevailing wind, and hazard of pollution are important factors that have not been evaluated here. They require investigation at the site proposed for use as a sewage lagoon.

Engineering Test Data

Table 5 shows engineering test data for six different soil series. The soils were tested by the Bureau of Public Roads.

The engineering soil classifications are based upon data obtained by mechanical analyses and by tests to determine the liquid limit and plasticity index. Mechanical analyses were made by combined sieve and hydrometer methods.

The liquid limit is the moisture content at which soil material passes from a plastic state to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The plasticity index is the numerical difference between the liquid limit and the plastic limit.

Formation and Classification of the Soils[7]

This section describes how the factors of soil formation have affected the formation of soils in the Cache Area. It also places the soil series represented in this survey area in categories of the current system of classification.

Factors of Soil Formation

The characteristics of a soil at any given point are determined by the interaction of five principal factors: (1) the parent material, (2) the climate under which the soil material has accumulated and has existed since accumulation, (3) the relief, or topography, which influences the local or internal environment of the soil and its drainage, moisture content, aeration, susceptibility to erosion, and exposure to sun and wind, (4) the biological forces, or the plants and animals living on or in the soil that have acted upon the soil material, and (5) the length of time the climatic and biological forces have acted upon the soil material.

The soils in the Cache Area show the interaction of all five factors of soil formation.

Parent material

The soils on the flood plains, recent alluvial fans, valley floors, deltas, and lake terraces in Cache Valley have formed in transported mixed alluvium. This parent material was derived dominantly from limestone, sandstone, quartzite, dolomite, and conglomerate rocks. It was deposited in the Cache Valley by streams. The waters of old Lake Bonneville later moved and sorted some of this material and formed the lake terraces as the lake receded (*12*).

The McMurdie soils formed in the fine-textured, mixed lake sediment on high lake terraces, and they are probably the oldest of the lake terrace soils. Battle Creek soils formed in fine-textured sediment on slightly lower terraces. Timpanogos, Parleys, and Hillfield soils formed in medium-textured and moderately fine textured material on intermediate and high terraces. Lewiston and Kidman soils formed in moderately coarse textured sediment on broad intermediate lake terraces. Ricks, Sterling, and Steed soils formed in coarse-textured, gravelly and cobbly sediment deposited near the mouth of canyons on deltas and on high or intermediate terraces. Preston soils formed in coarse-textured sediment that was modified by the action of wind after the lake receded.

The soils on the low lake terraces and on the floor of Cache Valley are somewhat poorly drained or poorly drained. Greenson, Roshe Springs, and Logan soils formed in the medium-textured and moderately fine textured sediment on the low terraces and on the floor of Cache Valley. Collett, Salt Lake, Trenton, and Nibley soils formed in the fine-textured sediment.

Recent post-Bonneville alluvium, deposited on flood plains and fans on the floor of Cache Valley, is the parent material for the Winn, Kirkham, and Shay soils. Winn soils formed in medium-textured material, Kirkham in moderately fine textured material, and Shay soils in fine textured material. These soils are somewhat poorly drained and are stratified.

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[7] THERON B. HUTCHINGS, soil scientist, Soil Conservation Service, assisted in the preparation of this section.

Local post-Bonneville alluvium, derived mostly from dolomitic rocks from Green Canyon, deposited as alluvial fans on intermediate terraces, is the parent material of the Green Canyon and Millville soils. These soils contain more than 40 percent carbonates. Green Canyon soils are higher on the fans than Millville soils, and they formed in very gravelly and cobbly, medium-textured material. Millville soils formed in medium-textured, nongravelly material lower on the fans. In places the Millville soils have a deep water table.

Light-colored rocks of Tertiary Age and tuffaceous standstone, tuff, and fresh limestone, commonly called the Salt Lake Formation, are the source of the parent material for a number of soils (*12*). This formation occurs both within and above the Lake Bonneville basin. Avon, Mendon, Crookston, Collinston, and Wheelon soils formed in material from the Salt Lake Formation that was moved and sorted by the waters of Lake Bonneville. Barfuss, Leatham, and LaPlatta soils are above the highest water level of Lake Bonneville. This material is mostly medium textured to fine textured. Crookston, Collinston, and Wheelon soils formed in the medium-textured material; Mendon, Leatham, and Barfuss soils formed in the moderately fine textured material; and Avon and LaPlatta soils formed in the fine textured material. These soils are relatively high in content of silt, and they contain a significant amount of volcanic ash or glass. They have high cation-exchange capacity and contain clays in which a 2:1 lattice type is dominant. These soils contain more than 2 milliequivalents of exchangeable potassium per 100 grams of soil.

In the mountainous areas, the parent material was derived from old Precambrian to the younger Tertiary rocks. These rocks are dominantly limestone, dolomite, quartzite, sandstone, and conglomerate. The soils in these areas formed in residuum, colluvium, and alluvium derived from these rocks. These soils vary widely in texture and in depth to bedrock.

Only a few soil characteristics or qualities have been noted that are related to a particular geologic formation.

Goring, Hoskin, Curtis Creek, St. Marys, Lucky Star, Scave, Cluff, Red Spur, and Scout soils formed mostly in material derived from red sandstone and conglomerate rocks of the Wasatch Formation. These soils are essentially free of carbonates and have color hues of 7.5YR or redder below the A horizon. The St. Marys and Hoskin soils formed in very cobbly residuum and colluvium derived from Wasatch conglomerate. More than 50 percent of their profile is rounded cobblestones and gravel.

Climate

The climate in the Cache Area ranges from dry subhumid to moist subhumid continental. Winters are cold, and summers are warm. Average annual precipitation generally ranges from 14 to 35 inches. Most of the precipitation is snow that falls from October to April. Seasonal and daily temperatures vary widely. The frost-free season on the floor of Cache Valley and on the lake terraces is 120 to 160 days. In the high, mountainous areas, frosts have occurred in every month of the year. Temperatures of less than 20° F. during winter and temperatures of more than 100° during summer are common.

In general, the climate and elevation are co-factors in the formation of soils. The amount of precipitation increases with increases in elevation. The relationship between climatic factors and elevation varies somewhat with exposure. Because of the exposure, there is some overlap in elevation in the different designated climate zones. On the floor of Cache Valley and on the lake terraces at elevations of 4,420 to 5,000 feet, the average annual precipitation is generally between 14 and 17 inches and the mean annual air temperature is 45° to 48°. These areas are referred to as the Upland climatic zone. Some high lake terraces, the high fans, and the foothill areas at elevations of 5,000 to 6,000 feet generally have 17 to 20 inches of precipitation annually and have a mean annual air temperature of 45° to 48°. This general area is transitional between the Upland climatic zone and the Mountain Climatic zone, depending a great deal on exposure and position.

In mountainous areas at elevations of 6,000 to 7,200 feet, the average annual precipitation generally is 20 to 25 inches, and the mean annual air temperature is 40° to 45°. This area is in the Mountain climatic zone. It is colder and receives more precipitation than the lower areas. The areas above 7,000 to 7,200 feet are in the High Mountain climatic zone. The average annual precipitation generally is 25 to 35 inches, and the mean annual air temperature is 36° to 42°. Typically, the soils above the 7,000 feet elevation, under vegetative cover of aspen or conifers, have an average soil temperature in summer of less than 60°.

The influence of climate is noticeable mainly in the amount of organic-matter accumulation in the surface layer and the translocation of minerals and clays to form distinct horizons.

Much of the moisture that falls during winter and early in spring is stored in the soil or percolates through the soil. Percolation has removed the more soluble salts from the soils on the high lake terraces, the high fans, and the mountains. In the Mountain and High Mountain climatic zones, the carbonates have either been translocated to form distinct lime horizons or have been leached from the soil.

Following or accompanying the leaching of carbonates, some silicate clay has been translocated or formed in place by alteration of minerals to form a B2t horizon.

In the Upland climatic zone, the Hillfield and Wheelon soils have a light-colored A1 horizon and a distinct lime horizon but no other horizonation. The Collinston and Sterling soils have a distinct lime horizon and a thin, dark-colored A1 horizon but very little other horizonation. The Ricks, Timpanogos, Parleys, and Battle Creek soils have a thin, dark A1 horizon, a weak to moderate B2t horizon, and a distinct lime horizon.

In the Mountain climate zone, the Sheep Creek, Datwyler, and Ant Flat soils have a thin, dark A1 horizon, a moderately developed to strongly developed B2t horizon, and a distinct lime horizon. The Crookston, Mendon, Avon, Barfuss, LaPlatta, Despain, Clegg, and McMurdie soils have a thick, dark A1 horizon. The organic-matter accumulation and dark colors extend to a depth of more than 20 inches. These soils have a moderately developed to strongly developed B2t horizon and a distinct lime horizon. The Goring, Hendricks, and Nebeker soils also have organic-matter accumulation and dark colors that extend to a depth of more than 20 inches, and they have a strong B2t horizon. In these soils, essentially all the carbonates are leached to a depth of 60 inches or more.

In the High Mountain precipitation zone, percolation has removed much of the soluble minerals and has translocated the silicate clays. A light-colored, bleached A2 horizon has formed in the Lucky Star, Red Spur, Scave, Flygare, Fitzgerald, and Cluff soils. These soils have a moderately developed to strongly developed B2t horizon below the A2 horizon. Carbonates and most soluble salts have all been leached from the soil.

The soils on the lower terraces and flood plains receive runoff from higher areas and in some places from upward-moving ground water. In many places this additional moisture has caused a high water table and impaired drainage. The Logan, Salt Lake, Greenson, Collett, Winn, and Roshe Springs series are examples of soils that formed under these conditions. These soils are calcareous throughout the profile and contain a distinct horizon where lime has accumulated. Soluble salts and alkali have accumulated in some soils of the valley bottoms and low terraces. The Cache soils for example, contain a large amount of soluble salts. The Trenton, Payson, and Airport soils are strongly alkali. These soils have a moderately developed to strongly developed horizon that has a prismatic or columnar structure. They have a high content of exchangeable sodium and a distinct horizon of lime accumulation.

Relief

Relief or landform influences soil formation principally by its effect on runoff, drainage, and microclimate. The dominant landforms or topographic features in the Cache Area are (1) valley floors, low terraces, and flood plains, (2) lake terraces, terrace escarpments, and deltas, (3) high fans, and (4) foothills and mountains.

Valley floors, lower terraces, and flood plains.—Drainage is slow on the level to gently sloping valley floors, stream flood plains, and low terraces of Cache Valley. In places the soils are ponded or have a high water table. These wet soils lack oxygen and are gleyed. The iron oxide and other compounds in the soil are reduced. Olive, yellowish, and bluish colors have formed, especially in the subsoil. The wetness causes water-loving plants to produce abundantly. This resulted in a high organic-matter content and dark colors in the surface layer of the Logan, Roshe Springs, and Salt Lake soils. The Winn, Kirkham, and Shay soils are similar to these soils and are typically on flood plains of permanent streams. The water table fluctuates, and the soils have yellowish mottles below a depth of 16 to 20 inches. In places these soils are subject to overflow from streams.

Trenton, Quinney, Airport, Payson, Lasil, and Jordan soils are on the low lake terraces. These soils have a moderately to strongly developed B horizon that has prismatic or columnar structure and is high in content of exchangeable sodium (natric horizon). Sodium clays have the property of swelling and dispersing when they are wet. Pore space, permeability, and aeration are greatly reduced. In drying, the soil mass contracts and cracks develop. Continuous wetting and drying forms distinct cleavages, and a typical prismatic or columnar structure forms in the B horizon.

Lake terraces, terrace escarpments, and deltas.—The steplike terraces of prehistoric Lake Bonneville are a prominent landform (*4*). The oldest terrace, the alpine level, has an elevation of 5,050 feet. The sediment is medium textured to fine textured and, in most places, is covered by sediment deposited when the lake was at its highest level. The McMurdie soils are on the old alpine terrace.

The highest terrace, the Bonneville, is readily observable throughout most of Cache Valley. The elevation is 5,135 feet. The Parleys, Mendon, and Timpanogos soils are dominant on this terrace. The B horizon in these soils is less distinct than in the McMurdie soils.

When the lake overflowed through Red Rock Pass, the water level decreased rapidly to an elevation of 4,820 feet and the upper Provo terrace was formed. Later the lake receded and formed another prominant terrace, the lower Provo, at an elevation of about 4,700 feet. The Ricks and Kidman soils are dominant on the Provo terraces. These soils have a weakly developed B horizon, and carbonates have been leached to a depth of 20 to 40 inches.

High fans.—The principal old fans in Cache Valley are in the Mountain climatic zone at elevations of 5,135 to 6,000 feet. They are generally just above the Bonneville terrace. In places these fans extend slightly below the Bonneville terrace. The dominant soils on these fans are the Hendricks, Crowshaw, Nebeker, and Hiibner. These soils are leached free of carbonates. They have a thick A1 horizon and a moderately developed to strongly developed B2t horizon.

Other high fans are at the foot of steep mountain slopes surrounding small valleys. Obray and some Yeates Hollow soils formed on these fans. These soils are fine textured. Obray soils are Vertic Haploxerolls that crack when they dry. Yeates Hollow soils have a strongly developed B2t horizon and are leached of carbonates.

Foothills and mountains.—These areas consist mostly of steep and very steep mountain slopes that have small intervening valleys and ridges, but they also include broad, sloping or moderately sloping foothills, fans, and stream terraces. The mountains surrounding Cache Valley rise rather abruptly from the high lake terraces. The elevation is 5,135 feet to more than 9,000 feet. The steep mountain slopes cause differences in climate. The steep south- and west-facing slopes are hot and dry. A considerable amount of snow melts, and the water runs off. The steep north- and east-facing slopes are cooler and more moist (fig. 18). Evaporation is less and the precipitation is used more efficiently. The vegetative cover is generally of different kinds and more dense on the north and east slopes at the same elevation. The Elzinga, Maughan, and Smarts soils are on northern exposures, mostly under dense cover of maple. They have a thick, dark A1 horizon and a moderately developed to strongly developed B2t horizon, and carbonates are leached to a depth of 60 inches or more. Maughan and Elzinga soils have a distinct A2 horizon. The Sheep Creek and Datwyler soils are at similar elevations but on south-facing slopes under a cover of shrubs and grasses. They have a

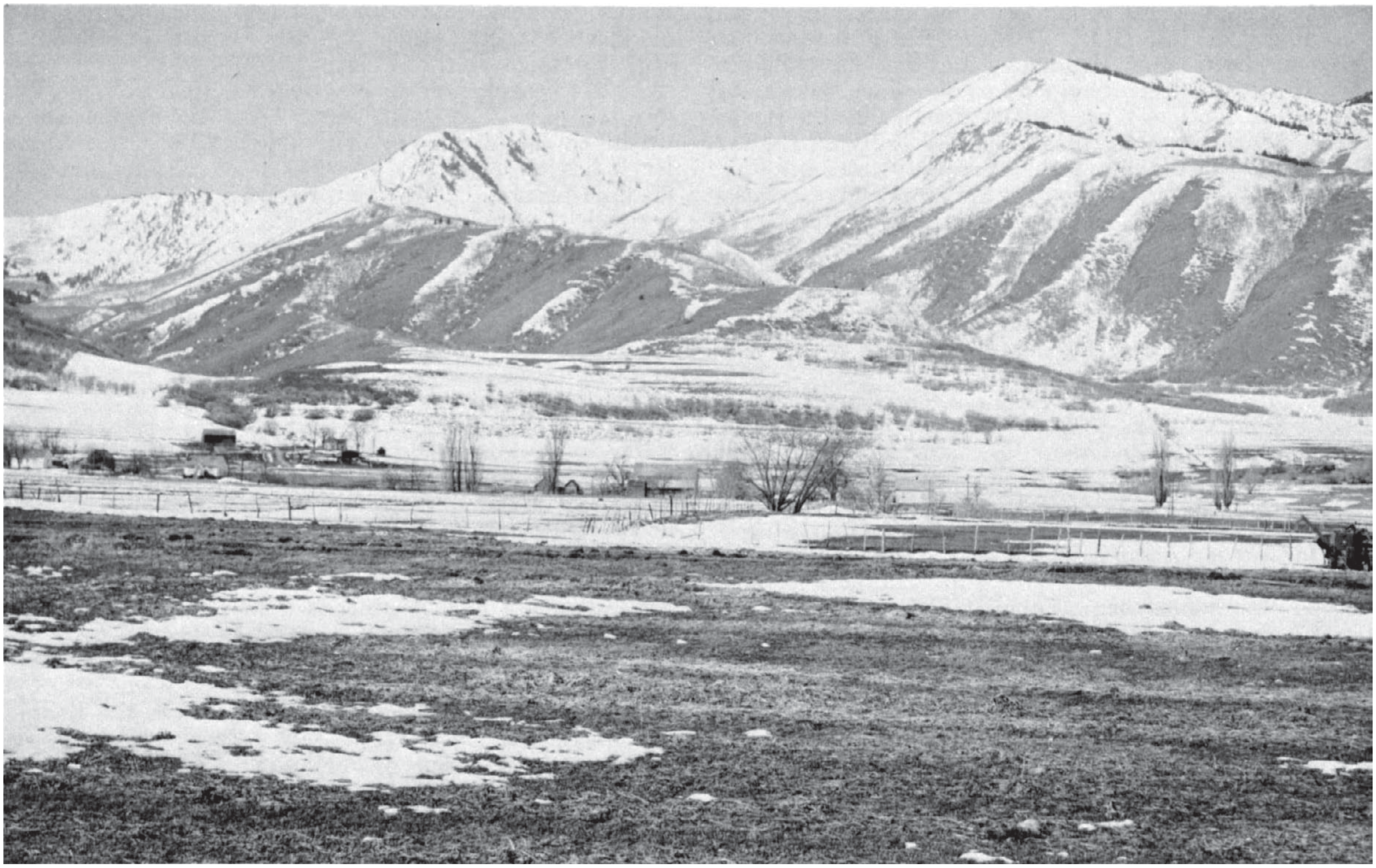

Figure 18.—**East side of Wellsville Mountains showing the influence of aspect on the cover of snow. In the part of the mountains shown in the middle part of the picture, snow has remained on the north-facing slopes much longer than on the south-facing slopes. Mendon and Avon are the soils of the mountain that have north-facing slopes. Poleline and Datwyler soils have the south-facing slopes.**

thinner solum, and carbonates have accumulated to form a lime horizon within a depth of 36 inches.

In the High Mountain climate zone, Douglas-fir, alpine fir, and aspen are dominant on the steep, north- and east-facing mountain slopes. At the higher elevations, aspen and coniferous trees also grow on southern and western exposures. The soils on these steep mountain slopes have a mean summer temperature of less than 59° F. at a depth of 20 inches. The Cluff and Fitzgerald soils that formed under conifers are extensively leached. They have a thin organic horizon, a thin, dark-colored A1 horizon, and a thick, bleached A2 horizon over a strongly developed B2t horizon. The percentage of base saturation is generally 50 to 75 percent. The Lucky Star, Red Spur, Flygare, and Scave soils that formed under aspen have a thick, dark-colored A1 horizon, a bleached A2 horizon, and a moderately developed to strongly developed B2t horizon.

Plants and animals

Plants strongly influence the kind, amount, and position of organic matter in the soil. Living organisms influence soil structure and porosity and thus influence the rate of air and water movement through the soil. Plants and animals mix the soil and may retard horizon formation. The decay of forest litter causes the formation of acids. These acids, in solution, hasten the leaching processes, and bases are leached rapidly from the soil.

The Cache Area contains the following six main plant zones:

Water-loving plant zone.—Reeds, sedges, saltgrass, foxtail, and wiregrass on the wet flood plains and valley bottoms contributed large amounts of organic matter to the Logan, Salt Lake, Roshe Springs, and Winn soils of this zone. These soils have a dark, thick A1 horizon. Some areas of these soils have been drained and are cultivated.

On the semiwet, low lake terraces and alluvial fans, the dominant vegetation is saltgrass, alkali sacaton, Kentucky bluegrass, foxtail, and some Great Basin wildrye. The somewhat poorly drained Nibley, Trenton, Greenson, Collett, and Lewiston soils have a moderate to moderately low organic-matter content.

Bunchgrass zone.—Here the dominant vegetation is bluebunch wheatgrass, western wheatgrass, tall native bluegrass, Great Basin wildrye, and other perennial grasses and a small amount of sagebrush, bitterbrush, and snowberry. This vegetation produced dark-colored soils that have a moderate to moderately high organic-matter content. Most of the soils are leached of lime in the surface horizon and have moderate to strong structure in the B2t horizon. The soils are well drained and are on the gently sloping to moderately steep, intermediate and high lake terraces, high alluvial fans, and mountain foot slopes. Runoff is slow to medium. The main soils that formed under grass vegetation are the Parleys, McMurdie, Hendricks, Goring, Mendon, Ant Flat, and Nebeker. Most areas of these soils are cultivated in Cache Valley. The Leatham soil has been extensively reworked by rodents and earthworms. Such mixing has partly offset soil horizonation, and the carbonates have been redistributed throughout the profile. Light-colored specks and chunks of material from the C horizon are readily visible in the A and B horizons. Worm casts and krotovinas are plentiful.

Upland and mountain shrub-browse zone.—In this zone the dominant vegetation is woody species, such as bitterbrush, big sagebrush, yellowbrush, serviceberry, ceanothus, oakbrush, snowberry, birchleaf mahogany, and scattered juniper. These areas also have a considerable amount of bluebunch wheatgrass, western wheatgrass, Sandberg bluegrass, and Great Basin wildrye. The Sheep Creek, Yeates Hollow, Datwyler, Picayune, Sterling, and Agassiz soils under this vegetation are mostly very gravelly and cobbly or shallow. Generally, they have an A horizon that is neutral in reaction and that has a moderately low to moderate content of organic matter. Some of the soils show weak or moderate development of a B horizon.

Deciduous tree zone.—In this zone the vegetation is dominantly aspen and maple on north- and east-facing slopes at the lower elevations and on all slopes at high elevations. Generally, the aspen trees are in open stands and have a dense understory of mountain brome, blue wildrye, slender wheatgrass, snowberry, serviceberry, and bluebells. The stands of maple trees are dense and have little grass-shrub understory. Dominant soils under aspen are the Lucky Star, Red Spur, Flygare, and Scave. These soils have a thick A1 horizon, a distinct A2 horizon, and a strongly developed B horizon. In the Lucky Star and Red Spur soils, the B2t horizon is being broken down as evidenced by deep tonguing of the A2 horizon into the B horizon. The Mult soils, also under aspen, have formed on hard limestone and lack an A2 horizon. The main soils under maple are the Elzinga, Maughan, and Smarts.

Conifer tree zone.—In this zone the tree species are dominantly Douglas-fir, alpine fir, Engelmann spruce, and white fir. These trees are generally on northern and eastern exposures at elevations above 7,000 feet, but they also are on other exposures at the higher elevations. These trees have contributed comparatively small amounts of material to form organic matter in the soils. However, the organic acids formed by the decay of the litter from these trees have been effective in hastening leaching. Most of the soils under the coniferous trees are medium acid to slightly acid in reaction and are comparatively low in bases. The Cluff and Fitzgerald soils have a thin or no A1 horizon, a distinct A2 horizon, and a moderately developed to strongly developed B horizon. Other soils under conifers are the Bickmore, Dateman, and Elwood. These soils have formed in hard material weathered from limestone, and their horizons are not so distinct as those of other soils under conifers.

Time

Soil formation requires time. It may be a matter of centuries or a few years. The distinctness of soil horizons depends in part on the amount of time the processes of soil development have had to act.

Among the soils of the Cache Area, the young soils on the alluvial fans have the lowest degree of horizonation. The only horizon formed in the Steed, Millville, Green Canyon, and Dagor soils, all of which are on alluvial fans, is the accumulation of organic matter in the A1 horizon.

The alpine terrace of Lake Bonneville is believed to have formed during Illinoian time. The McMurdie soils that formed on this terrace have a thick, dark, leached A1 horizon and a distinct B horizon. The accumulation of organic matter extends to a depth of 30 to 36 inches. Silicate clays have been translocated, and the clay content of the B2t horizon is almost double that of the A1 horizon. Slight increase in redness of color in the B horizon indicates some increase of iron oxides. Carbonates have been leached from the A horizon and upper part of the B horizon and have accumulated at a depth of 25 to 40 inches. The later Bonneville level and upper Provo level of Lake Bonneville are generally considered as having formed in early Wisconsin time, whereas the lower Provo level formed in the middle Wisconsin time. The Timpanogos and Parleys soils that formed on the Bonneville and upper Provo levels show less influence of time than the McMurdie soils. The increase in organic-matter content is not so deep in the profile. In most places only the upper 18 to 20 inches of the soil shows an increase in organic matter. There has been significantly less movement of clay, and carbonates have not been leached so deeply.

The soils that formed on the high old alluvial fans above the Bonneville level are older than those on the lake terraces. The Nebeker soils that formed on these fans have a dark A1 horizon. Organic matter has accumulated, and the soil generally is slightly acid to a depth of 48 inches or more. Strong, thick, reddish-colored clay horizons have formed, and carbonates have been leached to a depth of 60 inches or more. The B horizon has more than twice the content of clay of the A1 horizon. The reddish color indicates a considerable content of iron oxides.

The oldest soils in the Cache Area are probably those of the Goring, Lucky Star, and Red Spur series. These soils formed in material derived from sandstone that was very low in carbonates. Goring soils are in the Mountain climatic zone under grasses and shrubs. The Goring soils have a thick, dark A1 horizon and a thick, red, strongly developed B2t horizon. The B2t horizon is below a depth of 24 inches and has a hue of 7.5YR or redder and a chroma of generally more than 4.

The Red Spur and Lucky Star soils of the High Mountain climatic zone have a thick, dark, medium acid A1 horizon that is moderately high in organic matter; a thick, medium acid, sandy A2 horizon that has been stripped of clay; and a red, medium acid B horizon. There is considerable tonguing of the A2 horizon into the B horizon. The red B horizon in these soils is high in content of iron oxide.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and later revised (*7*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. It is under continual study (*6*, *10*). Therefore, readers interested in developments of the current system should search the latest literature available. The soil series of the Cache Area are placed in some categories of the current system in table 6.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar mode of origin are grouped together. Most of the classes of the current system are briefly defined in the following paragraphs.

ORDER.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate in the soil orders are those that tend to give broad climatic groupings of soils. The two exceptions, the Entisols and Histosols, occur in many different kinds of climate. Table 7 shows that the six soil orders in the Cache Area are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, and Alfisols.

Entisols are young soils that have only weakly formed horizons or lack distinct horizons. Either they have accumulated less than 1 percent organic matter in the surface soil, or the dark-colored A horizon is less than 7 inches thick. These soils lack a B horizon, and carbonates and other salts have not been accumulated in sufficient quantity to form a distinct horizon (calcic or salic horizon).

Vertisols are clayey soils that crack deeply when dry. When the cracks are open, some of the surface soil is eroded or moved into the openings. Repeated wetting and swelling and drying and cracking cause a churning action in the soils. This keeps the soils young and they have not formed strong horizons, other than an accumulation of organic matter in the surface soil and some leaching of carbonates to form a distinct lime horizon (calcic hori-

TABLE 6.—*Classification of soil series*

[Placement of some series in the present system of classification may change as more precise information becomes available]

Series	Family	Subgroup	Order	Great soil group (1938)
Agassiz	Loamy-skeletal, mixed, frigid	Lithic Haploxerolls	Mollisols	Lithosols.
Airport	Fine-silty, mixed, mesic	Typic Natraquolls	Mollisols	Solonetz soils.
Ant Flat	Fine, montmorillonitic, frigid	Calcic Argixerolls	Mollisols	Chestnut soils.
Avon	Fine, montmorillonitic, mesic	Calcic Pachic Argixerolls	Mollisols	Chernozems.
Barfuss	Fine-silty, mixed	Pachic Udic Argiborolls	Mollisols	Chernozems.
Battle Creek	Fine. mixed, mesic	Vertic Argixerolls	Mollisols	Chestnut soils.
Bickmore	Loamy-skeletal, mixed	Argic Pachic Cryoborolls	Mollisols	Chernozems intergrading toward Gray Wooded soils.
Blackrock	Fine-loamy, mixed, mesic	Cumulic Haploxerolls	Mollisols	Alluvial soils.
Bradshaw	Loamy-skeletal, mixed, frigid	Typic Haploxerolls	Mollisols	Bruinzems.
Cache	Fine, mixed, mesic	Typic Salorthids	Aridisols	Solonchak soils.
Cardon	Fine, montmorillonitic, mesic	Chromic Pelloxererts	Vertisols	Grumusols.
Center Creek	Fine-loamy, mixed	Pachic Argiborolls	Mollisols	Chestnut soils intergrading toward Humic Gley soils.
Clegg	Fine-loamy, mixed, frigid	Calcic Pachic Argixerolls	Mollisols	Brunizems.
Cluff	Clayey-skeletal, montmorillonitic	Mollic Cryoboralfs	Alfisols	Gray Wooded soils.
Collett	Fine, mixed, mesic	Aquic Calciustolls	Mollisols	Calcium-carbonate Solonchak soils.
Collinston	Fine-silty, mixed, mesic	Typic Calcixerolls	Mollisols	Calcisols.
Crookston	Fine-loamy, mixed, mesic	Calcic Pachic Argixerolls	Mollisols	Chestnut soils.
Crowshaw	Fine-loamy, mixed, mesic	Typic Haploxerolls	Mollisols	Brunizems.
Curtis Creek	Loamy, mixed, frigid	Lithic Argixerolls	Mollisols	Brunizems.
Dagor	Fine-loamy, mixed, mesic	Cumulic Haploxerolls	Mollisols	Alluvial soils.
Dateman	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols	Bruinizems.
Datwyler	Clayey-skeletal, montmorillonitic, frigid.	Calcic Argixerolls	Mollisols	Chestnut soils.
Despain	Fine-loamy, mixed, frigid	Calcic Pachic Argixerolls	Mollisols	Chestnut soils.

See footnote at end of table.

TABLE 6.—*Classification of soil series*—Continued

Series	Family	Subgroup	Order	Great soil group (1938)
Elwood	Loamy-skeletal, mixed	Argic Cryoborolls	Mollisols	Brunizems.
Elzinga	Loamy-skeletal, mixed	Pachic Paleborolls	Mollisols	Brunizems.
Fitzgerald	Loamy-skeletal, mixed	Mollic Paleboralfs	Alfisols	Gray Wooded soils.
Flygare	Loamy-skeletal, mixed	Cryic Pachic Paleborolls	Mollisols	Gray Wooded soils.
Foxol	Loamy-skeletal, mixed, frigid	Lithic Haploxerolls	Mollisols	Lithosols.
Goring	Fine, montmorillonitic, frigid	Pachic Palexerolls	Mollisols	Brunizems.
Green Canyon	Loamy-skeletal, carbonatic, mesic	Typic Haploxerolls	Mollisols	Alluvial soils.
Greenson	Fine-silty, mixed, mesic	Aquic Calciustolls	Mollisols	Calcium-carbonate Solonchak soils.
Hendricks	Fine-silty, mixed, mesic	Pachic Argixerolls	Mollisols	Brunizems.
Hiibner	Clayey , skeletal, montmorillonitic, mesic.	Typic Argixerolls	Mollisols	Brunizems.
Hillfield	Coarse-silty, mixed, mesic	Calcixerollic Xerochrepts	Inceptisols	Calcisols.
Hoskin	Loamy-skeletal, mixed, frigid	Typic Argixerolls	Mollisols	Brunizems.
Hyrum	Loamy-skeletal, mixed, mesic	Pachic Argixerolls	Mollisols	Brunizems.
Jordan	Fine, mixed, mesic	Salorthidic Natrustalfs	Alfisols	Solonetz soils.
Kidman	Coarse-loamy, mixed, mesic	Calcic Haploxerolls	Mollisols	Chestnut soils.
Kirkham	Fine-silty, mixed, mesic	Fluvaquentic Haplustolls	Mollisols	Alluvial soils.
Lakewin	Loamy-skeletal, mixed, mesic	Calcic Haploxerolls	Mollisols	Regosols.
LaPlatta	Fine, montmorillonitic	Pachic Udic Argiborolls	Mollisols	Chernozems.
Lasil	Fine-silty, mixed, mesic	Typic Natrustalfs	Alfisols	Solonetz soils.
Layton	Sandy, mixed, mesic	Calcic Haploxerolls	Mollisols	Regosols.
Leatham	Fine-silty, carbonatic, frigid	Typic Haploxerolls	Mollisols	Alluvial soils.
Lewiston	Coarse-loamy, mixed, mesic	Aeric Calciaquolls	Mollisols	Calcium-carbonate Solonchak soils.
Logan	Fine-silty, mixed, mesic	Typic Calciaquolls	Mollisols	Humic Gley soils.
Lucky Star	Loamy-skeletal, mixed	Cryic Paleborolls	Mollisols	Gray Wooded soils. Brunizems.
Maughan	Fine, montmorillonitic	Pachic Paleborolls	Mollisols	Brunizems.
McMurdie	Fine, montmorillonitic, mesic	Calcic Pachic Argixerolls	Mollisols	Brunizems.
Mendon	Fine-silty, mixed, mesic	Calcic Pachic Argixerolls	Mollisols	Chernozems.
Middle	Loamy-skeletal, mixed, mesic	Calcic Haploxerolls	Mollisols	Chestnut soils.
Millville	Coarse-silty, carbonatic, mesic	Typic Haploxerolls	Mollisols	Alluvial soils.
Mult	Fine-loamy, mixed	Argic Cryoborolls	Mollisols	Brunizems.
Munk	Loamy-skeletal, mixed, mesic	Typic Calcixerolls	Mollisols	Calcisols.
Nebeker	Fine, montmorillonitic, mesic	Pachic Argixerolls	Mollisols	Brunizems.
Nibley	Fine, mixed, mesic	Aquic Argiustolls	Mollisols	Chestnut soils.
Obray	Fine, montmorillonitic, frigid	Vertic Haploxerolls	Vertisols	Grumusols.
Parleys	Fine-silty, mixed, mesic	Calcic Argixerolls	Mollisols	Chestnut soils.
Parlo	Fine-silty over sandy or sandy skeletal, mixed, mesic.	Calcic Argixerolls	Mollisols	Chestnut soils.
Payson	Fine, mixed, mesic	Typic Natrustalfs	Alfisols	Solonetz soils.
Picayune	Fine-loamy, mixed, frigid	Calcic Haploxerolls	Mollisols	Chestnut soils.
Poleline	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols	Lithosols.
Preston	Mixed, mesic	Typic Xeropsamment	Entisol	Regosols.
Provo	Sandy-skeletal, mixed, mesic	Typic Haplaquolls	Mollisols	Alluvial soils.
Quinney	Coarse-silty, mixed, mesic	Typic Natrixerolls	Mollisols	Solonetz soils.
Red Spur	Fine-loamy, mixed	Cryic Pachic Paleborolls	Mollisols	Gray Wooded soils.
Richmond[1]	Loamy-skeletal, carbonatic, mesic	Lithic Xerorthents	Entisols	Lithosols.
Ricks	Coarse-loamy over sand or sandy-skeletal.	Calcic Haploxerolls	Mollisols	Chestnut soils.
Roshe Springs	Fine-loamy, carbonatic, mesic	Typic Calciaquolls	Mollisols	Humic Gley soils.
St. Marys	Loamy-skeletal, mixed, frigid	Typic Haploxerolls	Mollisols	Brunizems.
Salt Lake	Fine, carbonatic, mesic	Typic Calciaquolls	Mollisols	Humic Gley soils.
Scave	Clayey-skeletal, montmorillonitic	Abruptic Cryic Paleborolls	Mollisols	Gray Wooded soils.
Scout	Loamy-skeletal, mixed	Typic Cryochrepts	Inceptisols	Sol Brun Acides.
Shay	Fine, montmorillonitic, mesic	Cumulic Haplustolls	Mollisols	Alluvial soils.
Sheep Creek	Loamy-skeletal, mixed, frigid	Calcic Argixerolls	Mollisols	Chestnut soils.
Smarts	Loamy-skeletal, mixed, frigid	Pachic-Ultic Argixerolls	Mollisols	Chernozems.
Steed	Fragmental, mixed, mesic	Entic Haploxerolls	Mollisols	Alluvial soils.
Sterling	Loamy-skeletal, mixed, mesic	Typic Calcixerolls	Mollisols	Calcisols.
Timpanogos	Fine-loamy, mixed, mesic	Calcic Argixerolls	Mollisols	Chestnut soils.
Trenton	Fine, mixed, mesic	Typic Natrixerolls	Mollisols	Solonetz soils.
Wheelon	Fine-silty, mixed, mesic	Calcixerollic Xerochrepts	Inceptisols	Calcisols.
Winn	Fine-loamy, mixed (calcareous), mesic	Cumulic Haplaquolls	Mollisols	Alluvial soils.
Woods Cross	Fine, montmorillonitic, noncalcareous, mesic.	Cumulic Haplaquolls	Mollisols	Humic Gley soils.
Yeates Hollow	Clayey-skeletal, montmorillonitic, frigid.	Typic Argixerolls	Mollisols	Brunizems.

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[1] The Richmond soils in the Richmond-Munk association, eroded, (REG2) are taxadjuncts to the Richmond series. They are very shallow and excessively drained, and they contain more ashy material than the defined range for the Richmond series.

zon). Gilgai microrelief, slickenslides, and wedge-shaped or parallelepiped structures are dominant characteristics of these soils.

Inceptisols are relatively young soils in which some rather definite horizons are beginning to form. These soils are generally moist and have a thin or light-colored A horizon or have an organic-matter accumulation of less than 1 percent in the upper 7 inches. They have formed a weak B2 horizon (cambic horizon) or a distinct horizon of carbonate accumulation (calcic horizon).

Aridisols are generally dry and have a light-colored or thin surface soil or contain less than 1 percent organic matter in the upper 7 inches. They have formed a strong lime horizon (calcic horizon) within a depth of 40 inches or a salt horizon (salic horizon) with more than 2 percent soluble salts within a depth of 30 inches.

Mollisols have a thick, dark-colored surface soil that contains 1 percent or more organic matter and 50 percent or more base saturation (mollic epipedon). About 95 percent of the acreage of soils in the Cache Area are Mollisols.

Alfisols have a B2t horizon (argillic or natric horizon) but lack a thick, dark-colored A1 horizon (mollic epipedon).

SUBORDER.—Orders are divided into suborders, primarily on the basis of the characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP.—Suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and properties. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans that interfere with growth of roots or movement of water. The properties used are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not

TABLE 7.—*Laboratory analyses*

[Dashes in columns indicate determinations were not made.The

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Airport silt loam.	0–4	0. 0	0. 1	0. 1	2. 1	10. 6	61. 6	25. 5	---------	12. 7
	4–11	0	. 1	. 1	2. 5	10. 5	57. 0	29. 8	---------	14. 9
	11–16	0	. 1	. 2	3. 5	12. 6	50. 9	32. 7	---------	14. 4
	16–25	. 1	. 1	. 3	5. 5	16. 2	43. 5	34. 3	---------	10. 5
	25–60	0	0	0	. 9	4. 9	72. 0	22. 2	---------	9. 7
Ant Flat loam.	0–7	. 3	. 7	1. 0	7. 1	21. 4	42. 6	26. 9	---------	12. 1
	7–11	. 2	. 7	1. 0	7. 2	20. 6	40. 5	29. 8	---------	11. 9
	11–18	. 2	1. 1	1. 4	5. 5	15. 4	37. 2	39. 2	2	14. 3
	18–32	. 6	1. 1	. 9	4. 2	10. 5	32. 4	50. 3	---------	18. 1
	32–40	. 3	. 9	. 9	4. 0	18. 7	43. 8	31. 4	13	12. 7
	40–48	. 3	. 8	. 8	4. 2	18. 4	45. 4	30. 1	4	13. 0
	48–60	. 5	1. 4	1. 4	6. 6	17. 4	39. 8	32. 9	11	14. 7
Bickmore gravelly silt loam.	0–2	0	. 1	. 1	. 4	3. 7	65. 9	29. 8	---------	16. 2
	2–16	. 1	. 1	. 1	. 4	4. 0	64. 5	30. 7	5	16. 1
	16–24	. 3	. 3	. 3	1. 0	4. 3	57. 1	36. 7	47	19. 4
	24–37	1. 0	2. 2	1. 8	3. 6	6. 1	55. 5	29. 8	67	14. 4
Blackrock gravelly loam.	0–8	7. 6	7. 7	3. 6	4. 9	7. 0	45. 1	24. 1	29	16. 2
	8–22	6. 2	7. 6	3. 6	4. 9	8. 2	41. 7	27. 8	21	16. 7
	22–39	5. 7	8. 0	4. 3	6. 0	8. 1	40. 8	27. 1	39	15. 6
	39–60	4. 2	5. 6	3. 6	6. 1	7. 0	37. 6	35. 9	11	17. 1
Cache silty clay.	0–4	. 1	. 1	. 1	. 1	1. 0	57. 6	40. 7	---------	14. 4
	4–16	0	. 1	. 1	. 2	. 7	43. 9	55. 0	---------	24. 2
	16–25	. 1	0	0	. 2	. 9	45. 5	53. 3	---------	24. 3
	25–30	0	. 1	. 1	. 3	1. 3	48. 1	50. 1	---------	25. 3
	30–39	0	0	0	. 1	. 8	46. 6	52. 5	---------	24. 5
	39–48	0	0	0	. 1	. 7	43. 7	55. 5	---------	25. 2
	48–60	. 1	0	0	. 2	1. 4	46. 3	52. 0	---------	(3)
	60–72	. 1	. 1	. 1	. 2	1. 1	48. 0	50. 4	---------	(3)

See footnotes at end of table.

shown separately in table 7, because it is the last word in the name of the subgroup.

Subgroup.—Great groups are divided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties integrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group.

Family.—Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

Series.—The series consists of a group of soils that formed in a particular kind of parent material and have genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at the state, regional, and national levels of responsibility for soil classification results in a judgement that the new series should be established. Some of the soil series described in this publication have been established earlier. Most are new and in tentative status. All have been classified and correlated according to 1966 criteria.

Laboratory Analyses

Results of laboratory analyses of selected soil profiles are shown in table 7. The analyses were made by the Soil Conservation Service and the Utah State University Cooperative Soils Laboratory, Logan, Utah.

of selected soils

symbol > means less than; the symbol > means more than]

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1:5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations: Sodium	Extractable cations: Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
7. 7	9. 1	2. 25	0. 208	10. 8	1. 53	18. 7	24. 8	1. 50	1. 52	6	--------	43
8. 0	9. 7	1. 27	. 105	12. 1	1. 53	12. 1	23. 8	6. 41	1. 38	27	--------	44
9. 2	10. 3	. 40	--------	--------	4. 08	40. 0	14. 9	10. 81	1. 08	73	--------	46
9. 7	10. 4	. 26	--------	--------	4. 53	70. 9	7. 4	6. 70	. 50	91	--------	34
9. 9	10. 4	. 16	--------	--------	3. 54	59. 0	8. 9	8. 40	. 52	94	--------	47
6. 2	7. 0	4. 29	. 299	14. 3	. 83	--------	27. 6	. 13	1. 04	--------	--------	64
6. 3	7. 2	2. 44	. 175	13. 9	. 96	--------	24. 1	. 18	1. 09	--------	--------	53
6. 6	8. 0	1. 22	--------	--------	1. 29	6. 7	24. 7	. 18	. 49	--------	--------	51
7. 1	8. 6	. 82	--------	--------	. 89	15. 0	33. 3	. 28	. 27	--------	--------	70
7. 1	8. 5	. 49	--------	--------	. 56	23. 8	23. 0	. 32	. 27	--------	--------	51
7. 1	8. 3	. 53	--------	--------	. 57	22. 3	21. 0	. 28	. 26	--------	--------	50
7. 1	8. 2	. 38	--------	--------	. 46	28. 7	22. 8	. 38	. 24	--------	--------	56
6. 5	7. 3	5. 61	. 307	18. 3	. 79	--------	45. 5	. 19	2. 30	--------	--------	66
6. 6	7. 3	3. 71	. 217	17. 1	. 78	--------	39. 0	. 26	1. 99	--------	--------	59
6. 7	7. 4	3. 16	--------	--------	. 86	--------	39. 5	. 27	1. 77	--------	--------	57
6. 8	7. 2	3. 47	--------	--------	. 76	30. 0	29. 6	. 24	1. 01	--------	--------	57
7. 0	8. 1	2. 92	. 247	11. 8	. 80	--------	40. 9	. 73	17. 80	2	--------	51
6. 9	8. 5	1. 68	. 131	12. 8	. 95	--------	39. 1	. 99	18. 10	2	--------	46
7. 3	8. 8	1. 05	--------	--------	. 72	--------	33. 0	1. 18	9. 80	4	--------	47
7. 8	9. 2	. 66	--------	--------	. 73	13. 7	28. 2	1. 12	3. 47	4	--------	51
7. 6	8. 3	. 60	. 056	10. 6	46. 8	25. 5	18. 7	4. 5	. 96	24	--------	58
7. 7	8. 4	. 33	. 030	11. 0	36. 0	25. 5	24. 2	8. 1	. 46	33	--------	106
7. 7	8. 3	. 31	. 034	9. 1	39. 0	27. 0	24. 4	9. 2	. 12	38	--------	103
7. 5	8. 2	. 46	--------	--------	42. 6	23. 8	28. 0	9. 0	. 20	32	--------	98
7. 5	8. 2	. 46	--------	--------	42. 6	24. 0	27. 0	4. 8	. 21	18	--------	101
7. 6	8. 2	. 46	--------	--------	42. 6	22. 4	26. 3	9. 7	. 26	37	--------	100
7. 6	8. 2	. 45	--------	--------	46. 8	21. 7	26. 4	5. 7	. 20	21	--------	96
7. 7	8. 3	. 43	--------	--------	39. 0	21. 5	26. 0	7. 7	. 70	30	--------	95

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Cardon silty clay.	0–7	0.1	0.2	0.7	3.0	1.5	40.0	54.5	---------	23.7
	7–11	0	.1	.5	3.2	1.9	40.4	53.9	---------	23.4
	11–22	0	.1	.4	2.4	1.5	40.9	54.7	---------	21.1
	22–34	0	.1	.2	1.3	.9	43.1	54.4	---------	19.2
	34–43	0	0	.1	.6	.6	43.9	54.8	---------	18.6
	43–62	0	0	0	.2	.8	47.4	51.5	---------	18.5
Cluff silt loam.	0–4	3.4	4.5	3.0	8.5	5.2	62.1	13.3	34.7	7.8
	4–9	4.1	4.4	3.1	8.8	16.6	50.0	13.0	35.0	6.9
	9–24	4.1	5.0	3.6	10.0	20.1	44.8	12.4	53.2	5.1
	24–31	4.1	3.9	3.0	8.9	16.3	38.4	25.4	65.6	8.3
	[1] 31–44	4.1	4.4	3.4	9.2	15.7	36.0	27.2	40.8	9.8
	44–62	4.0	4.2	3.1	9.2	17.7	33.9	27.9	39.2	10.0
Collett silty clay loam.	0–7	.2	.3	.4	1.0	4.2	59.7	34.2	---------	18.5
	7–12	.1	.3	.3	1.2	4.3	59.7	34.1	---------	18.4
	12–17	.1	.1	.2	1.0	4.2	58.8	35.6	---------	17.7
	17–24	0	.1	.2	.6	3.6	56.0	39.5	---------	15.3
	24–34	.2	.8	1.0	1.5	3.7	52.8	40.0	---------	13.5
	34–60	0	.2	.3	.7	4.2	58.0	36.6	---------	16.9
Collinston loam.	0–8	.2	1.0	1.6	9.8	23.5	46.5	17.4	---------	---------
	8–15	.8	1.5	2.0	5.2	14.8	48.9	26.8	---------	---------
	15–25	.2	2.2	3.7	8.6	12.1	43.8	29.4	---------	---------
	25–35	.1	.9	1.4	3.1	11.5	59.4	23.6	---------	---------
	35–47	.1	.5	.7	2.0	14.8	60.8	21.1	---------	---------
	47–60	.1	.3	.6	1.2	12.8	63.8	21.2	---------	---------
Crookston loam.	0–6	.1	.8	2.5	33.5	11.2	35.8	16.1	---------	11.7
	6–14	.2	1.4	2.6	35.6	3.3	38.9	18.0	---------	12.4
	14–27	.1	1.0	2.3	35.2	5.8	35.0	20.6	---------	14.0
	27–48	.3	2.4	4.5	39.4	2.4	32.5	18.5	---------	12.9
	48–60	.6	2.4	4.5	42.1	3.7	31.3	15.4	---------	11.4
Crowshaw gravelly loam.	0–10	2.0	2.0	1.5	5.2	19.9	49.5	19.9	18	10.2
	10–16	3.3	2.5	1.5	5.5	19.3	47.6	20.3	15	9.7
	16–30	1.8	2.0	1.6	6.0	21.2	44.8	22.6	25	9.8
	30–60	2.7	3.1	2.2	8.0	22.7	38.9	22.4	30	9.8
Datwyler cobbly silty clay loam.	0–4	.3	1.1	1.4	2.3	13.5	42.3	39.1	(2)	15.9
	4–11	.7	1.8	1.6	5.5	9.2	36.6	44.6	(2)	19.3
	11–28	.3	1.4	2.4	9.8	6.7	25.6	53.8	(2)	25.8
	28–35	2.4	10.1	8.1	16.6	8.7	24.1	30.0	(2)	12.8
Elzinga silt loam.	0–8	.5	.6	.9	4.0	13.0	61.9	19.1	(2)	20.8
	8–22	.8	1.0	1.0	4.1	12.1	61.9	19.1	(2)	17.9
	22–26	1.6	2.6	2.1	6.5	15.4	57.7	14.1	(2)	6.7
	26–48	2.2	4.6	3.2	8.5	19.0	51.0	11.5	(2)	5.6
	48–62	.5	2.0	3.8	14.0	24.7	42.3	13.7	(2)	5.5
Goring silt loam.	0–3	.1	1.0	.9	3.2	15.5	54.0	25.4	---------	12.5
	3–7	.2	.8	.8	2.6	14.7	54.6	26.3	---------	11.8
	7–13	.6	1.5	1.0	2.6	12.5	53.0	28.8	---------	12.6
	13–22	.2	.9	.8	2.0	11.8	46.6	37.7	---------	13.5
	22–35	.0	.1	.2	1.4	16.3	38.6	43.4	---------	16.3
	35–60	.1	.6	.7	2.7	11.9	44.0	40.0	---------	13.6
Green Canyon gravelly loam.	0–9	3.9	4.1	2.6	8.2	15.2	49.4	16.6	[2] 20	8.8
	9–16	6.8	5.3	3.4	10.4	17.3	40.5	16.3	[2] 20	7.6
	16–23	10.4	8.3	6.3	20.6	21.8	25.7	6.9	[2] 50	3.3
	23–36	17.8	19.7	11.5	19.9	13.8	12.5	4.8	[2] 70	2.0
	36–42	17.6	18.3	11.6	18.7	14.8	15.0	4.0	[2] 70	1.9

See footnotes at end of table.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1:5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
7.6	8.3	2.50	0.207	12.1	0.9	5.5	41.0	0.4	1.60	1	--------	72
7.6	8.4	1.65	.142	11.6	.7	5.6	40.2	.4	1.24	1	--------	73
7.5	8.5	.78	.084	9.3	.6	18.8	32.0	.5	1.00	2	--------	72
7.8	8.6	.54	--------	--------	.8	29.9	27.2	.6	.85	2	--------	67
8.0	8.9	.37	--------	--------	.9	35.6	25.6	.6	.80	3	--------	73
8.0	9.0	.28	--------	--------	.9	35.9	23.0	.7	.77	3	--------	74
6.0	6.2	2.34	.126	18.6	.91	--------	16.8	.13	.84	--------	58	43
6.1	6.5	1.28	.088	14.5	.62	--------	14.2	.15	.95	--------	60	37
5.9	6.6	.56	--------	--------	.43	--------	8.8	.13	.63	--------	58	27
5.4	6.3	.31	--------	--------	.27	--------	14.1	.17	.69	--------	72	30
5.2	6.3	.35	--------	--------	.17	--------	17.0	.17	.79	--------	72	33
5.2	5.9	.40	--------	--------	.22	--------	17.0	.17	.79	--------	71	32
7.6	8.2	1.88	.186	10.1	1.48	4.9	29.3	.71	3.29	2	--------	56
7.8	8.5	1.31	.139	9.4	1.18	2.8	27.6	.69	1.47	2	--------	54
7.9	8.9	.81	.089	9.1	1.40	12.2	24.3	.85	1.43	3	--------	54
8.4	9.4	.52	--------	--------	1.22	22.3	12.5	.51	.81	4	--------	54
8.4	9.3	.31	--------	--------	.83	60.3	15.0	.56	.70	4	--------	63
8.1	9.2	.28	--------	--------	.56	35.6	18.0	.63	1.28	4	--------	58
7.6	8.6	2.24	--------	--------	.94	7.2	27.8	--------	--------	--------	--------	52
7.5	8.6	1.52	--------	--------	.85	4.2	32.9	--------	--------	--------	--------	50
7.6	9.0	.88	--------	--------	1.49	56.8	18.1	--------	--------	--------	--------	52
8.1	9.6	--------	--------	--------	.85	32.7	19.5	--------	--------	--------	--------	52
8.2	9.6	--------	--------	--------	.94	29.5	19.6	--------	--------	--------	--------	52
8.3	9.6	--------	--------	--------	1.06	28.3	19.9	--------	--------	--------	--------	56
7.7	8.8	1.67	.119	14.0	.69	--------	25.2	.4	5.0	2	--------	42
7.8	8.4	1.74	.122	14.3	.67	--------	26.9	.5	5.0	2	--------	49
7.5	8.7	1.02	.101	10.1	.70	--------	26.0	.7	4.9	3	--------	52
7.5	9.3	.49	--------	--------	.50	26.4	17.6	.5	4.2	3	--------	43
7.6	8.9	.41	--------	--------	.50	29.8	16.4	.5	5.2	3	--------	48
6.3	6.9	2.30	.163	14.1	.5	--------	23.9	.4	.7	--------	81	40
6.3	6.9	1.30	.103	12.6	.3	--------	19.6	.3	.6	--------	82	39
6.2	7.1	.74	.073	10.1	.3	--------	16.7	.3	.6	--------	83	39
6.5	7.3	--------	--------	--------	.2	--------	16.7	.3	.4	--------	87	40
7.1	8.0	1.30	.118	11.0	.37	--------	30.7	.15	1.71	<1	--------	45
7.1	8.0	1.37	.116	11.8	.24	1.2	24.2	.21	1.16	<1	--------	52
7.0	7.9	1.46	--------	--------	.32	--------	43.9	.19	1.11	<1	--------	67
7.6	8.8	1.04	--------	--------	.42	63.6	14.3	.13	.23	<1	--------	46
6.4	7.4	7.28	.518	14.1	.28	--------	43.1	.15	1.59	--------	69	52
6.3	7.3	5.13	.400	12.8	.25	--------	37.0	.13	1.27	--------	66	70
6.3	7.1	.75	--------	--------	.24	--------	12.6	.18	.22	--------	71	36
6.3	7.0	.41	--------	--------	.29	--------	10.1	.11	.19	--------	73	28
6.4	7.1	.48	--------	--------	.28	--------	9.6	.20	.19	--------	74	27
6.5	7.0	3.46	.242	14.3	.80	--------	28.2	.08	1.85	--------	69	47
6.4	7.3	1.99	.162	12.3	.56	--------	25.1	.11	1.81	--------	71	42
6.3	7.3	1.28	--------	--------	.48	--------	23.5	.13	1.53	--------	72	45
6.3	7.3	.84	--------	--------	.33	--------	24.5	.19	1.12	--------	72	44
6.1	7.3	.48	--------	--------	.16	--------	29.2	.22	.47	--------	82	47
6.3	7.4	.20	--------	--------	.14	--------	21.9	.21	.36	--------	88	44
7.9	8.8	1.77	.168	10.5	.66	21.2	18.9	.29	.60	2	--------	33
7.9	8.9	.98	.102	9.6	.69	24.4	17.5	.30	.45	2	--------	30
8.0	9.0	.56	--------	--------	.63	39.7	6.2	.32	.27	5	--------	21
8.2	9.3	.26	--------	--------	.66	44.1	3.3	.30	.27	9	--------	18
8.0	9.4	.23	--------	--------	.76	47.3	2.9	.29	.24	10	--------	16

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Greenson loam.	0–7	0.1	0.3	1.3	6.6	24.5	45.2	22.0	---------	11.1
	7–16	0	.2	1.6	7.8	24.5	43.3	22.6	---------	6.7
	16–23	0	.2	2.1	10.8	28.6	39.1	19.2	---------	9.8
	23–27	0	.2	1.9	12.2	28.2	33.0	24.5	---------	11.8
	27–39	0	.3	2.3	13.4	30.1	33.5	20.4	---------	9.9
	39–51	0	.3	1.9	12.5	32.7	37.8	14.8	---------	6.9
	51–63	0	.2	.7	6.3	35.1	47.3	10.4	---------	8.4
	63–72	0	.2	.3	2.0	21.5	66.0	10.4	---------	6.5
Hendricks silt loam.	0–5	.3	1.3	1.6	2.5	8.4	62.2	23.7	---------	11.0
	5–15	.4	1.3	1.5	2.3	8.3	61.6	24.6	---------	11.9
	15–27	.3	1.0	1.2	2.1	7.3	57.7	30.4	---------	13.1
	27–48	.9	2.5	2.6	3.8	8.7	52.7	28.8	---------	12.6
	48–66	.7	2.0	2.4	4.5	8.6	44.9	36.9	---------	17.9
Hiibner gravelly clay loam.	0–3	2.4	2.3	1.5	4.6	23.3	38.1	27.8	24	13.0
	3–6	1.7	2.1	1.4	4.0	19.6	33.9	37.3	28	15.1
	6–12	4.8	4.0	2.0	3.8	14.5	26.1	44.8	48	18.8
	12–27	5.9	6.7	3.7	6.5	12.3	15.7	49.2	50	21.9
	27–60	11.7	11.5	4.4	5.8	8.8	16.2	41.6	59	19.0
Hillfield silt loam.	0–8	0	.5	.5	1.6	19.4	58.4	19.6	---------	8.9
	8–15	0	.5	.5	1.2	29.6	53.7	14.5	---------	7.2
	15–23	0	.6	.4	1.2	32.7	49.3	15.8	---------	7.3
	23–40	0	.4	.3	1.7	47.6	38.8	11.2	---------	5.0
	40–60	0	.4	.2	1.8	51.9	37.3	8.4	---------	4.4
Hoskin cobbly loam.	0–7	1.9	4.9	3.8	11.5	17.7	44.1	16.1	(2)	7.7
	7–16	1.4	4.1	3.5	11.1	16.9	42.9	20.1	(2)	9.6
	16–28	1.2	4.2	3.5	11.2	18.5	41.0	20.4	(2)	9.5
Hyrum gravelly loam.	0–8	4.3	2.4	1.7	5.6	22.5	43.5	20.0	[2] 25	13.1
	8–17	5.9	2.9	1.6	5.3	21.7	35.6	27.0	[2] 12	11.7
	17–31	4.6	2.3	1.7	5.8	23.8	32.6	29.2	[2] 20	11.8
	31–42	5.5	2.9	1.8	5.3	17.5	34.9	32.1	[2] 17	13.8
	42–60	5.4	2.1	1.7	8.6	32.1	29.1	21.0	[2] 11	10.3
Jordan silty clay loam.	0–5	.6	.4	.3	.9	3.4	60.7	33.7	---------	11.2
	5–10	0	.1	.1	.4	1.3	40.8	57.3	---------	17.6
	10–21	0	0	0	.1	1.7	50.1	48.1	---------	20.9
	21–42	0	0	.1	.4	7.3	58.8	33.4	---------	19.1
	42–68	0	0	0	.2	1.8	52.5	45.5	---------	18.3
Kidman fine sandy loam.	0–8	0	.6	6.2	36.7	21.6	24.8	10.1	---------	---------
	8–12	0	.6	5.6	34.8	23.5	23.5	12.0	---------	---------
	12–20	0	.4	4.2	36.3	27.5	19.7	11.9	---------	---------
	20–27	0	.4	3.5	39.4	33.9	12.5	10.3	---------	---------
	27–43	0	.3	4.3	43.5	34.6	11.8	5.5	---------	---------
	43–60	.1	1.8	19.2	68.5	6.6	2.6	1.2	---------	---------
Kirkham silt loam.	0–9	.0	.3	.4	4.9	12.8	63.7	17.9	---------	13.4
	9–15	.1	.1	.1	1.0	6.2	62.1	30.4	---------	16.3
	15–23	.0	.1	.1	.6	4.3	66.0	28.9	---------	16.1
	23–60	.0	.1	.3	3.3	5.6	66.5	24.2	---------	13.3
Lakewin gravelly coarse sandy loam.	0–7	7.6	30.0	19.2	4.3	3.5	24.4	11.0	23	6.4
	7–18	6.9	30.6	20.5	4.5	3.7	21.6	12.2	19	6.1
	18–27	5.7	40.1	28.4	4.6	2.6	11.4	7.2	34	4.3
	27–34	9.2	36.0	25.9	7.2	4.2	17.5	0	35+	3.6
	34–60	8.6	31.2	28.8	15.1	6.2	10.1	0	68	2.8

See footnotes at end of table.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1: 5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
7. 7	8. 2	1. 81	0. 154	11. 8	0. 99	1. 1	24. 1	0. 90	0. 83	4	--------	45
7. 7	8. 4	1. 01	. 117	8. 6	. 77	2. 0	23. 3	. 98	. 73	4	--------	47
7. 9	8. 7	. 58	. 076	7. 6	. 93	2. 5	19. 1	1. 14	. 49	6	--------	45
8. 1	9. 1	. 48	. 061	7. 8	. 73	35. 1	13. 3	1. 06	. 30	8	--------	46
8. 0	9. 1	. 36	--------	--------	. 72	33. 0	10. 6	. 97	. 35	9	--------	38
8. 1	9. 2	. 23	--------	--------	. 78	31. 3	10. 8	1. 05	. 46	10	--------	30
8. 2	9. 2	. 22	--------	--------	. 67	26. 7	11. 5	. 92	. 51	8	--------	33
8. 2	9. 1	. 10	--------	--------	. 50	25. 8	12. 8	1. 05	. 59	8	--------	35
6. 8	7. 5	2. 26	. 199	11. 4	1. 0	----------	22. 2	. 25	1. 69	1	--------	39
6. 4	7. 3	1. 74	. 161	10. 8	. 38	----------	21. 6	. 36	. 95	2	--------	38
6. 2	7. 5	. 83	. 098	8. 5	. 35	----------	18. 4	. 35	. 89	2	--------	36
6. 4	7. 3	. 45	--------	--------	. 37	----------	17. 6	. 42	. 84	2	--------	38
6. 3	7. 3	. 32	--------	--------	. 39	----------	26. 2	. 37	. 71	1	--------	49
6. 9	8. 3	3. 63	. 267	13. 6	1. 40	----------	23. 8	. 29	2. 04	--------	86	54
6. 6	7. 7	2. 56	. 192	13. 3	1. 11	----------	26. 8	. 35	1. 45	--------	82	51
6. 2	7. 7	1. 75	. 134	13. 0	1. 09	----------	30. 7	. 31	. 95	--------	85	55
6. 1	7. 7	. 52	--------	--------	. 70	----------	34. 5	. 33	. 71	--------	83	64
6. 2	7. 7	1. 00	--------	--------	. 46	----------	27. 7	. 37	. 60	--------	86	49
7. 4	8. 5	. 79	. 090	8. 8	. 57	22. 5	14. 5	. 18	. 75	2	--------	40
7. 5	8. 6	. 29	. 038	7. 6	. 44	27. 8	12. 8	. 35	. 46	3	--------	39
7. 6	8. 0	. 19	. 033	5. 8	. 44	27. 5	12. 1	. 33	. 46	3	--------	37
7. 8	8. 5	. 06	--------	--------	. 45	22. 5	9. 22	. 31	. 36	3	--------	33
7. 8	8. 6	. 08	--------	--------	. 35	22. 6	7. 32	. 32	. 34	4	--------	31
6. 8	7. 5	2. 30	. 167	13. 8	1. 30	----------	18. 8	. 14	. 89	--------	71	36
7. 0	7. 6	1. 92	. 162	11. 9	. 32	----------	21. 9	. 19	. 43	--------	74	41
6. 8	7. 6	1. 77	--------	--------	. 41	. 5	22. 1	. 18	. 38	--------	81	41
6. 9	7. 9	3. 80	. 277	13. 7	1. 09	----------	29. 8	. 2	2. 07	--------	87	50
6. 8	7. 8	2. 33	. 186	12. 5	. 74	----------	27. 0	. 2	1. 18	--------	89	42
7. 1	8. 0	1. 38	. 128	10. 8	. 65	----------	25. 7	. 3	. 76	--------	--------	44
7. 1	7. 8	. 83	. 088	9. 4	. 38	----------	28. 7	. 3	. 85	--------	--------	49
7. 4	7. 8	. 42	. 060	7. 0	. 48	----------	21. 3	. 2	. 63	--------	--------	39
8. 1	8. 8	1. 16	. 118	9. 8	9. 4	1. 3	20. 1	5. 3	----------	26	--------	54
8. 2	8. 6	. 77	. 089	8. 7	12. 4	11. 0	26. 5	10. 4	----------	39	--------	73
8. 7	9. 2	--------	--------	--------	22. 5	30. 3	21. 1	9. 8	----------	47	--------	91
8. 8	9. 2	--------	--------	--------	12. 4	20. 6	19. 1	12. 2	----------	64	--------	89
8. 8	9. 3	--------	--------	--------	6. 9	23. 0	22. 5	13. 8	----------	61	--------	108
7. 5	8. 3	. 72	--------	--------	1. 13	----------	8. 8	. 29	. 71	3	--------	30
7. 5	8. 1	. 43	--------	--------	. 77	----------	8. 3	. 30	. 57	4	--------	29
7. 4	8. 3	. 31	--------	--------	1. 49	----------	7. 9	. 29	. 46	4	--------	28
7. 5	8. 2	. 24	--------	--------	. 72	----------	6. 6	. 30	. 35	5	--------	27
7. 9	9. 0	--------	--------	--------	. 60	8. 9	4. 4	. 24	. 30	5	--------	26
8. 3	9. 2	--------	--------	--------	. 43	7. 2	1. 8	. 37	. 14	21	--------	30
8. 0	9. 1	2. 02	. 177	11. 4	. 67	27. 2	23. 6	. 59	. 76	3	--------	55
7. 7	8. 7	1. 75	. 173	10. 1	. 76	19. 5	27. 6	. 67	. 62	2	--------	67
7. 6	8. 7	1. 46	--------	--------	. 95	17. 9	27. 8	. 49	. 57	2	--------	64
7. 7	8. 8	. 62	--------	--------	. 95	22. 4	21. 6	. 92	. 54	4	--------	57
7. 2	8. 3	1. 08	. 097	11. 1	. 65	----------	13. 9	. 2	. 93	1	--------	23
7. 4	8. 2	. 66	. 069	9. 6	. 51	----------	13. 6	. 2	. 74	1	--------	23
7. 6	7. 8	. 38	. 041	9. 3	. 71	----------	8. 4	. 1	. 41	2	--------	21
7. 8	8. 4	. 30	. 040	7. 5	. 57	----------	8. 6	. 2	. 33	2	--------	20
8. 0	8. 6	. 16	. 020	8. 0	. 36	18. 1	5. 2	. 2	. 28	4	--------	24

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Lasil silty clay loam.	0–5	0	0. 1	0	0. 2	1. 6	68. 8	29. 3	---------	12. 8
	5–13	. 1	. 6	0	. 7	3. 5	62. 9	32. 2	---------	13. 4
	13–23	0	. 2	0	. 5	3. 7	60. 1	35. 5	---------	14. 8
	23–32	0	. 2	0	. 4	3. 5	59. 0	36. 9	---------	15. 5
	32–39	0	. 2	0	. 4	3. 2	57. 4	38. 8	---------	17. 2
	39–60	0	. 1	. 1	. 3	5. 0	59. 3	35. 2	---------	16. 7
Leatham silt loam.	0–4	. 7	. 7	1. 0	6. 9	14. 4	45. 7	30. 6	---------	15. 1
	4–10	. 4	. 6	. 9	6. 6	14. 1	44. 3	33. 1	---------	17. 2
	10–15	. 1	. 3	. 4	3. 4	8. 1	52. 8	34. 9	---------	19. 5
	15–25	. 2	. 2	. 3	2. 3	15. 8	56. 7	24. 5	---------	13. 2
	25–39	. 0	. 1	. 5	4. 0	15. 2	51. 7	28. 5	---------	14. 3
Lewiston fine sandy loam.	0–10	0	1. 2	10. 4	48. 4	14. 5	18. 2	7. 3	---------	4. 9
	10–13	. 1	1. 0	8. 9	46. 5	16. 6	9. 7	17. 2	---------	6. 1
	13–22	. 1	. 9	7. 3	36. 0	16. 0	19. 7	20. 0	---------	8. 1
	22–32	. 1	. 8	7. 0	40. 3	21. 3	13. 4	17. 1	---------	5. 6
	32–60	. 1	. 7	5. 7	58. 7	18. 5	9. 9	6. 4	---------	6. 5
Logan silty clay loam.	0–13	---------	---------	---------	---------	---------	---------	---------	---------	25. 8
	13–26	---------	---------	---------	---------	---------	---------	---------	---------	17. 5
	26–45	---------	---------	---------	---------	---------	---------	---------	---------	21. 1
	45–60	---------	---------	---------	---------	---------	---------	---------	---------	22. 7
Lucky Star gravelly silt loam.	0–5	2. 1	3. 4	2. 5	5. 3	14. 0	58. 5	14. 2	(2)	22. 2
	5–13	2. 0	1. 9	2. 4	6. 4	14. 1	58. 7	14. 5	(2)	15. 9
	13–26	2. 7	5. 5	4. 0	8. 9	21. 9	49. 9	7. 1	(2)	4. 0
	26–35	5. 4	8. 9	6. 4	15. 8	25. 8	32. 2	5. 5	(2)	3. 9
	35–55	5. 5	10. 6	6. 2	16. 7	25. 8	30. 1	5. 1	(2)	3. 9
	55–70	3. 1	4. 7	3. 2	7. 4	20. 8	41. 6	19. 2	(2)	9. 2
	70–72	2. 8	5. 7	3. 8	9. 5	24. 0	41. 0	13. 2	(2)	6. 3
Maughan silt loam.	0–8	1. 1	1. 3	. 8	2. 3	9. 0	62. 9	22. 6	---------	24. 0
	8–25	. 4	. 8	. 8	1. 9	9. 2	62. 3	24. 6	---------	16. 9
	25–32	. 8	1. 6	1. 6	4. 4	6. 5	64. 2	20. 9	---------	9. 7
	32–38	1. 3	5. 4	3. 7	6. 6	11. 1	32. 8	39. 0	---------	17. 5
	38–50	1. 4	3. 8	3. 4	5. 1	6. 4	26. 0	53. 9	---------	24. 2
	50–66	1. 9	4. 5	3. 9	5. 2	8. 6	32. 3	43. 6	---------	20. 3
McMurdie silt loam.	0–7	. 3	1. 0	1. 5	1. 3	7. 6	63. 3	25. 0	---------	12. 3
	7–14	. 1	. 8	1. 5	1. 1	8. 1	57. 4	31. 0	---------	17. 8
	14–25	0	. 2	. 3	. 6	4. 6	47. 3	47. 0	---------	27. 7
	25–33	. 1	. 2	. 3	. 5	3. 8	48. 5	46. 6	---------	23. 7
	33–43	0	. 2	. 5	1. 1	10. 4	60. 2	27. 6	---------	17. 2
	43–50	0	. 8	1. 7	22. 1	14. 9	42. 3	18. 2	---------	10. 4
	50–58	. 2	17. 6	30. 3	9. 5	7. 6	22. 7	12. 1	---------	7. 4
Mendon silt loam.	0–7	. 2	1. 4	2. 5	2. 7	8. 9	61. 1	23. 2	---------	11. 4
	7–24	. 1	. 9	1. 7	10. 3	8. 0	43. 2	35. 8	---------	17. 6
	24–28	0	1. 1	2. 0	14. 9	4. 4	44. 0	33. 6	---------	ins.
	28–34	. 4	3. 1	5. 5	31. 0	7. 6	34. 4	18. 0	---------	10. 9
	34–40	. 5	2. 9	5. 1	32. 5	9. 0	32. 7	17. 3	---------	9. 4
	40–48	. 4	1. 7	1. 9	26. 8	13. 5	37. 2	18. 5	---------	10. 4
Millville silt loam.	0–6	. 3	. 7	1. 1	7. 6	19. 4	54. 6	16. 3	---------	8. 7
	6–12	. 2	. 4	. 9	6. 9	18. 3	57. 8	15. 5	---------	8. 8
	12–24	0	. 1	. 3	4. 1	16. 6	63. 2	15. 7	---------	10. 5
	24–35	. 1	. 1	. 3	5. 0	18. 6	60. 3	15. 6	---------	7. 1
	35–49	. 1	. 1	. 3	4. 7	19. 4	59. 9	15. 5	---------	7. 9
	49–65	. 1	. 3	. 5	6. 8	22. 5	60. 7	9. 1	---------	---------

See footnotes at end of table.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1:5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
7.3	8.3	2.13	0.188	11.3	1.7	1.1	24.2	0.7	2.69	3	--------	49
8.0	8.9	1.12	.106	10.6	1.8	1.8	23.1	2.2	2.22	10	--------	47
7.9	8.8	.70	.069	10.1	7.3	2.8	23.0	3.2	1.76	23	--------	51
8.1	9.0	.63	--------	--------	9.8	5.6	21.8	7.9	1.28	36	--------	54
8.2	9.0	.48	--------	--------	8.5	11.3	21.3	10.7	1.00	50	--------	61
8.4	8.8	.16	--------	--------	12.9	25.5	20.6	14.2	.51	69	--------	73
7.3	8.6	2.21	.209	10.6	.59	31.4	26.8	.20	1.22	--------	--------	52
7.2	8.7	1.91	.185	10.3	.95	32.8	29.3	.14	1.02	--------	--------	54
7.4	8.8	1.67	--------	--------	.64	49.8	25.9	.09	.67	--------	--------	60
7.5	8.9	.71	--------	--------	.43	53.3	16.7	.18	.35	--------	--------	48
7.6	9.2	.40	--------	--------	.44	60.2	18.1	.16	.35	--------	--------	54
7.8	9.1	.60	.062	9.7	1.85	2.0	9.7	.7	.97	7	--------	25
8.0	9.1	.42	.053	7.9	1.40	2.7	9.5	.7	.74	7	--------	26
8.4	9.5	.39	.044	8.9	1.36	28.7	6.8	.9	.47	13	--------	27
8.7	9.7	.16	.019	8.4	1.61	18.3	5.3	.8	.39	15	--------	28
8.6	9.6	.08	.014	5.7	1.85	13.4	3.3	.6	.33	17	--------	25
7.7	8.7	3.82	.337	11.3	.96	12.2	5.0	.90	.05	2	--------	79
8.0	8.9	.84	.065	12.9	.50	44.7	18.2	.52	.03	3	--------	74
7.9	8.8	.27	--------	--------	.38	33.5	21.6	.53	.03	2	--------	83
8.0	8.9	.22	--------	--------	.41	23.6	27.5	.73	.04	3	--------	105
6.3	7.3	8.48	.553	15.3	.50	--------	52.6	.15	1.59	--------	75	86
6.2	7.2	5.18	.372	13.9	.41	--------	38.2	.11	1.18	--------	69	69
6.0	7.0	.33	--------	--------	.19	--------	6.80	.07	.23	--------	79	22
6.1	7.0	.16	--------	--------	.15	--------	5.03	.06	.21	--------	68	21
6.0	6.8	.23	--------	--------	.15	--------	5.71	.09	.24	--------	65	20
6.1	6.5	.19	--------	--------	.23	--------	13.6	.11	.49	--------	73	34
6.1	6.5	.16	--------	--------	.25	--------	9.6	.11	.35	--------	63	26
6.6	7.4	6.94	.528	13.1	.43	--------	46.6	.12	1.61	--------	68	81
6.2	7.2	4.08	.341	12.0	.27	--------	36.9	.17	1.39	--------	65	61
6.3	6.9	.81	--------	--------	.61	--------	16.9	.12	.51	--------	79	37
6.0	6.8	.83	--------	--------	.24	--------	29.4	.14	.73	--------	73	50
6.3	7.1	.94	--------	--------	.26	--------	40.3	.29	.60	--------	74	66
7.0	8.0	.82	--------	--------	.28	--------	33.4	.20	.48	--------	--------	66
7.2	8.1	1.86	.145	12.8	.44	1.2	31.7	.2	1.40	1	--------	43
7.1	8.0	1.51	.118	12.8	.46	--------	26.8	.3	1.11	1	--------	44
6.8	8.0	.72	.068	10.6	.35	--------	34.2	.3	1.14	1	--------	65
6.7	8.0	.69	.061	11.3	.37	--------	38.0	.3	.86	1	--------	68
7.2	8.4	.45	.052	8.7	.44	25.9	25.8	.4	.58	2	--------	53
7.4	8.6	.27	.033	8.2	.53	31.4	17.9	.4	.44	2	--------	39
7.5	8.7	.16	.014	11.4	.56	27.8	12.3	.3	.40	3	--------	30
7.3	8.4	1.86	.135	13.8	.44	--------	23.3	.2	2.6	1	--------	42
7.1	8.1	1.12	.110	10.2	.82	--------	27.2	.3	3.8	1	--------	57
7.6	8.5	([3])	--------	--------	.66	36.5	20.3	.3	2.5	2	--------	53
7.5	8.8	.42	--------	--------	.48	42.7	12.2	.4	1.2	3	--------	44
7.8	9.1	.36	--------	--------	.33	35.3	12.2	.4	.9	3	--------	39
7.7	9.0	.19	--------	--------	.44	16.9	15.3	.4	.9	2	--------	42
7.9	8.4	1.36	.129	10.5	.52	43.6	13.9	.94	.78	7	--------	35
7.9	8.6	1.27	.121	10.5	.45	43.9	14.0	.85	.72	6	--------	36
8.0	8.9	.72	.076	9.5	.35	49.9	11.8	.97	.59	8	--------	37
8.0	8.9	.45	.053	8.5	.34	63.0	8.6	.96	.45	11	--------	34
8.1	9.0	.38	--------	--------	.37	70.4	6.7	.71	.30	10	--------	32
8.2	9.1	.28	--------	--------	.34	73.0	6.0	.79	.29	13	--------	28

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Mult silt loam.	0–4	0. 8	4. 1	2. 7	4. 6	5. 9	53. 0	28. 9	---------	14. 3
	4–14	. 4	3. 5	3. 0	5. 4	6. 7	53. 1	27. 9	---------	12. 5
	14–22	. 8	3. 7	2. 5	4. 0	4. 8	53. 3	30. 9	---------	12. 9
	22–24	. 3	2. 1	1. 7	3. 6	4. 7	52. 5	35. 1	---------	14. 4
Nebeker silt loam.	0–8	. 6	1. 0	1. 0	2. 1	11. 9	63. 1	20. 3	15	9. 2
	8–14	. 8	. 9	1. 0	2. 0	10. 6	58. 6	26. 1	13	11. 3
	14–26	. 6	. 8	1. 0	1. 9	9. 8	55. 8	30. 1	8	12. 3
	26–38	. 8	1. 4	1. 9	4. 3	8. 9	27. 5	55. 2	9	23. 9
	38–48	1. 4	2. 7	2. 7	5. 8	10. 4	20. 4	56. 6	11	23. 3
	48–55	2. 2	2. 7	2. 4	7. 5	16. 5	28. 0	40. 7	11	18. 5
	55–70	2. 2	3. 1	2. 7	9. 5	19. 8	33. 9	28. 8	12	12. 3
Nibley silty clay loam.	0–7	. 1	. 2	. 5	2. 7	3. 9	53. 0	39. 6	---------	16. 1
	7–13	0	. 2	. 4	1. 8	3. 2	54. 8	39. 6	---------	16. 9
	13–20	0	. 1	. 3	1. 2	1. 7	44. 2	52. 5	---------	20. 3
	20–32	0	. 1	. 1	. 5	1. 2	53. 2	44. 9	---------	16. 4
	32–43	0	. 1	. 1	. 2	1. 3	52. 0	46. 3	---------	17. 8
	43–60	0	. 1	. 1	. 3	2. 5	57. 7	39. 3	---------	19. 5
Obray silty clay.	0–7	. 1	. 2	. 2	. 6	6. 8	44. 0	48. 1	---------	21. 1
	7–22	0	. 2	. 2	. 6	6. 6	43. 7	48. 7	---------	23. 2
	22–32	. 2	. 3	. 3	. 6	6. 3	44. 5	47. 8	---------	23. 3
	32–39	. 1	. 3	. 3	. 6	6. 2	47. 4	45. 1	---------	23. 8
	39–52	. 2	. 5	. 5	. 9	5. 5	49. 0	43. 4	---------	24. 1
	52–60	. 6	2. 2	2. 1	3. 0	7. 5	47. 4	37. 2	---------	21. 6
Parleys silt loam.	0–8	. 2	. 3	. 2	2. 6	23. 8	52. 2	20. 7	---------	9. 0
	8–12	0	. 1	. 2	4. 0	24. 4	45. 9	25. 4	---------	11. 7
	12–19	0	. 1	. 2	4. 2	25. 5	41. 6	28. 4	---------	12. 9
	19–31	. 2	. 1	. 2	2. 0	18. 8	48. 0	30. 7	---------	14. 2
	31–36	0	. 1	. 1	. 9	18. 0	61. 7	19. 2	---------	9. 5
	36–52	0	. 6	1. 1	3. 2	27. 1	55. 1	12. 9	---------	7. 3
	52–68	. 1	1. 0	1. 2	3. 1	24. 6	58. 7	11. 3	---------	6. 3
Preston fine sand.	0–6	. 8	6. 6	22. 0	51. 4	7. 5	7. 3	5. 2	---------	2. 4
	6–15	1. 6	6. 8	21. 9	51. 2	6. 4	3. 8	8. 3	---------	2. 3
	15–26	2. 0	2. 1	21. 9	52. 0	7. 5	8. 1	6. 4	---------	2. 5
	26–38	1. 1	3. 6	16. 6	61. 3	10. 6	1. 3	5. 5	---------	1. 8
	38–50	. 4	3. 9	17. 5	61. 7	11. 4	3. 5	1. 6	---------	1. 5
	50–64	. 2	2. 1	14. 0	60. 5	15. 8	5. 8	1. 6	---------	1. 5
Provo gravelly loam.	2–0	. 6	1. 3	1. 5	4. 1	8. 0	57. 5	27. 0	---------	59. 8
	0–7	2. 8	4. 9	3. 1	5. 2	11. 4	51. 9	20. 7	30	16. 0
	7–13	2. 4	4. 9	3. 3	5. 8	13. 1	48. 2	22. 3	51	13. 8
	13–19	4. 0	5. 9	3. 8	6. 9	15. 6	42. 2	21. 6	78	11. 2
	19–27	3. 3	6. 4	4. 8	8. 6	18. 8	40. 7	17. 4	87	8. 3
	27–60	8. 6	12. 6	8. 5	10. 6	16. 4	32. 8	10. 5	93	(3)
Quinney silt loam.	0–8	0	17. 7	3. 0	2. 0	7. 8	58. 2	11. 3	---------	7. 0
	8–12	0	0	. 2	9. 4	32. 9	42. 2	15. 3	---------	10. 1
	12–18	0	0	. 2	9. 5	33. 4	37. 8	19. 1	---------	11. 2
	18–26	0	0	. 2	7. 6	26. 4	40. 6	25. 2	---------	11. 2
	26–39	0	. 1	. 2	8. 0	30. 0	39. 8	21. 9	---------	10. 0
	39–60	0	0	. 1	. 6	2. 9	56. 2	40. 2	---------	19. 5
Richmond very stony loam.	0–8	5. 0	5. 6	3. 2	9. 9	19. 0	46. 6	10. 7	[4] 20	6. 0
	8–13	5. 1	5. 8	3. 2	8. 6	17. 4	46. 6	13. 3	[4] 50	6. 6
	13–18	6. 9	7. 9	4. 4	9. 0	15. 0	45. 8	11. 0	[4] 80	6. 2
Roshe Springs silt loam.	0–8	. 6	1. 8	7. 7	6. 4	12. 3	57. 5	18. 7	---------	---------
	8–14	. 4	. 9	1. 9	7. 5	11. 9	59. 7	17. 7	---------	---------
	14–23	. 0	. 1	. 2	1. 2	5. 9	73. 6	19. 0	---------	---------
	23–35	. 0	. 1	. 2	. 5	2. 3	88. 8	8. 1	---------	---------
	35–50	. 0	. 1	. 1	. 4	7. 5	70. 5	21. 4	---------	---------

See footnotes at end of table.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1:5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
6. 2	7. 1	3. 80	0. 267	14. 2	0. 57	--------	30. 7	0. 21	1. 63	--------	74	56
5. 9	6. 9	2. 03	. 137	14. 8	. 38	--------	24. 2	. 15	1. 42	--------	74	46
6. 0	7. 0	. 69	--------	--------	. 32	--------	22. 4	. 18	1. 39	--------	81	50
6. 4	7. 4	1. 04	--------	--------	. 56	--------	24. 6	. 17	1. 33	--------	85	51
6. 1	6. 9	1. 73	. 140	12. 4	. 40	--------	21. 5	. 28	1. 24	--------	78	37
6. 0	6. 6	. 92	. 106	8. 7	. 40	--------	19. 2	. 31	. 92	--------	81	40
6. 3	7. 0	. 56	--------	--------	. 30	--------	20. 6	. 31	. 65	--------	81	41
6. 5	7. 5	. 59	--------	--------	. 70	--------	36. 6	. 52	. 83	--------	88	67
6. 8	7. 5	. 54	--------	--------	. 48	--------	44. 7	. 66	. 92	--------	89	72
7. 3	8. 0	. 40	--------	--------	. 80	--------	29. 4	. 55	. 76	--------	--------	58
7. 6	8. 3	. 27	--------	--------	1. 04	2. 7	22. 0	. 58	. 62	--------	--------	44
7. 6	8. 7	1. 59	. 154	10. 3	. 85	--------	29. 3	. 45	1. 49	2	--------	49
7. 5	8. 7	1. 54	. 149	10. 3	. 51	--------	28. 5	. 36	1. 39	1	--------	51
7. 7	9. 0	. 69	. 080	8. 6	. 60	10. 6	28. 2	. 44	. 98	2	--------	58
8. 0	9. 3	. 44	--------	--------	. 83	39. 7	21. 6	. 53	. 55	2	--------	62
8. 6	9. 6	. 24	--------	--------	. 59	47. 7	18. 7	. 53	. 82	3	--------	67
8. 3	9. 7	. 13	--------	--------	. 61	33. 9	21. 3	. 61	1. 26	3	--------	71
6. 5	7. 6	1. 00	. 088	11. 4	. 51	--------	37. 5	. 28	1. 17	1	--------	64
6. 3	7. 6	. 69	. 055	12. 5	. 29	--------	39. 2	. 40	. 90	1	--------	64
6. 9	8. 2	. 67	--------	--------	. 42	--------	40. 0	. 74	. 90	2	--------	65
7. 2	8. 7	. 55	--------	--------	. 48	2. 0	39. 7	. 85	. 87	2	--------	69
7. 6	9. 1	. 23	--------	--------	. 52	13. 0	40. 5	1. 42	. 86	4	--------	71
7. 7	9. 0	. 15	--------	--------	. 67	19. 7	35. 1	1. 73	. 72	5	--------	60
6. 8	7. 6	1. 48	. 131	11. 3	. 72	--------	20. 5	. 37	1. 47	--------	90	35
6. 8	7. 8	. 83	. 086	9. 7	. 50	--------	20. 0	. 33	1. 24	--------	90	39
6. 9	7. 8	. 47	. 061	7. 7	. 37	--------	22. 2	. 36	1. 04	--------	87	43
6. 6	7. 6	. 52	--------	--------	. 35	--------	26. 9	. 41	. 83	--------	87	49
7. 4	8. 3	. 44	--------	--------	. 49	17. 3	16. 7	. 28	. 60	--------	--------	41
7. 6	8. 6	. 26	--------	--------	. 43	28. 4	10. 9	. 35	. 56	--------	--------	35
7. 7	8. 8	. 14	--------	--------	. 56	27. 0	10. 5	. 12	. 22	--------	--------	34
7. 4	7. 6	. 35	. 033	10. 6	--------	--------	4. 2	. 20	. 38	5	--------	22
7. 5	7. 6	. 21	. 025	8. 4	--------	--------	4. 8	. 20	. 38	4	--------	25
7. 6	7. 6	. 09	. 015	6. 0	--------	--------	3. 4	. 20	. 32	6	--------	26
7. 8	7. 6	. 03	. 007	4. 3	--------	--------	2. 9	. 14	. 30	5	--------	25
7. 8	7. 5	. 06	--------	--------	--------	--------	2. 5	. 14	. 28	6	--------	27
7. 8	7. 9	. 05	--------	--------	--------	--------	2. 8	. 20	. 31	7	--------	23
7. 8	9. 0	13. 61	1. 165	11. 7	2. 0	25. 3	50. 2	1. 68	2. 65	--------	--------	143
7. 8	8. 6	1. 82	. 132	13. 8	. 8	4. 9	26. 2	. 98	1. 19	--------	--------	--------
7. 6	8. 4	1. 03	. 080	12. 9	. 6	5. 4	22. 5	--------	--------	--------	--------	--------
7. 6	8. 6	. 65	. 061	10. 7	. 7	22. 5	12. 8	--------	--------	--------	--------	--------
7. 6	8. 6	. 59	. 054	10. 7	. 8	30. 4	6. 1	--------	--------	--------	--------	--------
([3])	([3])	--------	--------	--------	--------	39. 4	4. 3	--------	--------	--------	--------	--------
7. 8	9. 0	. 75	. 075	10. 0	. 96	. 5	13. 5	. 58	1. 18	4	--------	29
8. 0	9. 7	. 58	. 068	8. 5	1. 57	. 8	15. 6	3. 51	1. 20	23	--------	38
8. 7	10. 2	. 39	--------	--------	2. 15	5. 5	13. 8	6. 61	1. 11	48	--------	34
9. 3	10. 5	. 28	--------	--------	4. 89	30. 7	10. 0	7. 33	. 75	73	--------	43
9. 3	10. 4	. 21	--------	--------	6. 11	26. 0	9. 5	8. 18	. 81	86	--------	42
8. 9	10. 2	. 21	--------	--------	6. 11	30. 7	18. 5	13. 22	1. 23	71	--------	72
7. 8	8. 8	. 91	. 093	9. 8	. 77	47. 6	10. 2	. 12	. 35	1	--------	24
7. 6	8. 8	. 85	. 095	8. 9	. 53	40. 0	9. 9	. 10	. 21	1	--------	29
7. 7	8. 9	. 68	--------	--------	. 63	48. 1	5. 9	. 10	. 08	2	--------	29
8. 1	8. 9	1. 85	--------	--------	1. 25	11. 4	26. 3	. 50	. 30	2	--------	51
8. 1	9. 0	. 88	--------	--------	. 92	50. 4	11. 5	. 31	1. 92	3	--------	52
8. 0	9. 0	. 39	--------	--------	. 69	50. 7	10. 7	. 29	1. 04	3	--------	50
8. 1	9. 0	--------	--------	--------	. 61	34. 9	13. 6	. 34	. 83	3	--------	51
8. 1	9. 0	--------	--------	--------	. 55	29. 7	12. 0	. 32	. 57	3	--------	47

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
St. Marys gravelly very fine sandy loam.	0–9	1. 9	4. 6	5. 2	15. 9	24. 7	35. 0	12. 6	32	8. 5
	9–16	1. 5	6. 3	14. 6	27. 7	16. 1	21. 5	12. 3	34	6. 3
	16–27	4. 0	10. 4	11. 0	22. 6	22. 7	22. 1	7. 2	55	3. 3
	27–60	2. 9	9. 7	9. 0	17. 4	21. 4	28. 9	10. 7	66	8. 4
Salt Lake silty clay.	0–6	3. 5	. 4	. 2	. 4	. 4	43. 0	52. 1	---------	36. 2
	6–16	. 3	. 7	. 6	1. 6	3. 4	47. 0	46. 4	---------	19. 4
	16–36	. 1	. 2	. 2	. 7	2. 2	41. 3	55. 3	---------	18. 5
	36–66	0	. 1	. 1	. 2	. 7	41. 4	57. 5	---------	21. 2
Scave silt loam.	0–10	. 7	1. 4	1. 3	5. 6	14. 8	54. 3	21. 9	[2] 5	12. 4
	10–16	1. 3	2. 5	1. 7	5. 1	12. 8	55. 6	21. 0	[2] 15	9. 9
	16–34	2. 0	3. 6	2. 6	11. 4	30. 0	38. 5	11. 9	[2] 35	5. 2
	34–46	2. 3	4. 3	2. 6	7. 3	15. 7	42. 3	42. 0	[2] 60	17. 6
Scout gravelly loam.	0–4	3. 4	4. 0	2. 9	8. 5	22. 6	49. 9	8. 7	34. 7	6. 9
	4–11	4. 5	4. 8	2. 9	9. 3	23. 5	46. 9	8. 1	39. 0	4. 9
	11–18	4. 2	4. 9	3. 5	10. 8	25. 8	45. 2	5. 6	38. 2	2. 9
	18–32	3. 4	5. 7	4. 2	14. 2	31. 2	37. 3	4. 0	39. 7	1. 8
	32–62	13. 0	10. 9	5. 0	12. 0	17. 7	38. 6	2. 8	83. 3	1. 9
Shay silty clay loam.	0–14	. 1	1. 3	. 4	2. 4	10. 2	55. 0	29. 8	---------	---------
	14–30	0	0	. 1	. 4	1. 4	44. 3	53. 8	---------	---------
	30–44	. 5	. 8	1. 9	7. 6	14. 8	50. 9	23. 5	---------	---------
	44–58	. 1	. 2	2. 6	31. 7	26. 7	27. 2	11. 5	---------	---------
Steed gravelly loam.	0–5	1. 6	5. 0	5. 8	11. 1	13. 7	44. 7	18. 1	23	10. 5
	5–11	2. 2	5. 8	6. 1	11. 2	13. 6	40. 5	20. 6	35	10. 1
	11–17	4. 0	11. 5	10. 4	14. 1	12. 6	29. 7	17. 7	69	8. 3
	17–60	15. 9	28. 3	18. 2	15. 3	6. 9	8. 6	6. 8	79	2. 9
Trenton silty clay loam.	0–8	0	. 1	. 1	. 4	2. 7	65. 9	30. 8	---------	13. 0
	8–15	0	. 1	. 1	. 2	1. 7	54. 3	43. 6	---------	19. 3
	15–26	0	. 1	. 1	. 3	1. 4	56. 0	42. 1	---------	17. 8
	26–34	0	0	0	. 1	. 2	46. 7	53. 0	---------	18. 5
	34–46	0	0	0	. 1	. 3	42. 9	56. 7	---------	21. 8
	46–60	0	0	0	. 2	. 4	41. 6	57. 8	---------	23. 9
	60–72	0	0	. 1	. 1	. 6	46. 0	53. 2	---------	24. 3
Wheelon silt loam.	0–6	. 1	. 4	. 5	2. 6	15. 4	54. 3	26. 7	---------	17. 1
	6–12	0	. 2	. 2	1. 5	11. 8	54. 3	32. 0	---------	20. 5
	12–23	0	. 2	. 3	1. 9	15. 9	54. 6	27. 1	---------	16. 5
	23–35	0	. 6	1. 3	5. 0	16. 9	52. 0	24. 2	---------	15. 6
	35–43	. 2	1. 4	1. 6	3. 5	15. 1	58. 2	20. 0	---------	16. 9
	43–66	. 2	1. 8	1. 5	2. 5	13. 8	57. 6	22. 6	---------	18. 5
Yeates Hollow extremely stony silt loam (in an area of Yeates Hollow extremely rocky silt loam).	0–11	2. 6	7. 6	5. 2	7. 6	7. 3	50. 6	19. 1	(2)	7. 2
	11–18	3. 5	7. 0	4. 7	6. 4	5. 6	47. 0	25. 8	(2)	9. 1
	18–33	3. 7	7. 8	5. 6	8. 1	6. 7	30. 0	38. 1	(2)	12. 5
	33–46	2. 0	8. 2	7. 1	11. 0	7. 8	30. 7	32. 2	(2)	13. 1

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[1] Values are representative of a mixture of A2 and B2t horizons that could not be separated in sampling.

[2] Fragments greater than 3 inches in diameter were discarded from sample.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1: 5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
6. 2	7. 3	3. 04	0. 227	13. 3	0. 66	--------	20. 6	0. 14	0. 45	--------	71	48
6. 2	7. 0	1. 45	. 118	12. 2	. 52	--------	13. 6	. 10	. 24	--------	82	37
6. 7	7. 4	. 55	--------	--------	. 58	--------	5. 8	. 10	. 08	--------	97	29
6. 7	8. 1	1. 88	--------	--------	. 95	8. 3	14. 1	. 12	. 10	--------	91	54
7. 6	8. 2	12. 1	. 833	14. 5	2. 3	18. 2	53. 8	1. 7	. 80	3	--------	113
8. 0	8. 6	2. 06	. 172	12. 0	1. 5	49. 6	23. 5	1. 4	. 67	6	--------	65
8. 3	8. 6	. 75	--------	--------	2. 7	44. 1	20. 2	3. 9	1. 12	19	--------	66
8. 9	9. 4	. 31	--------	--------	2. 3	36. 0	23. 1	7. 8	1. 40	34	--------	92
5. 8	6. 7	4. 34	. 269	16. 1	. 62	. 1	30. 8	. 20	1. 68	--------	72	53
6. 0	6. 9	1. 46	. 121	12. 1	. 39	--------	20. 1	. 18	1. 07	--------	74	39
6. 1	7. 0	. 47	--------	--------	. 42	--------	8. 3	. 17	. 41	--------	74	27
5. 6	6. 7	. 56	--------	--------	. 26	--------	32. 0	. 25	1. 07	--------	87	52
6. 5	7. 4	2. 38	. 123	19. 3	. 90	--------	14. 6	. 15	. 71	--------	72	43
6. 4	7. 0	1. 23	. 059	20. 8	. 55	--------	9. 5	. 13	. 57	--------	58	32
6. 0	6. 3	. 25	--------	--------	. 40	--------	4. 5	. 13	. 25	--------	60	22
5. 6	6. 5	. 07	--------	--------	. 17	--------	2. 1	. 12	. 08	--------	67	19
5. 5	6. 3	. 04	--------	--------	. 26	--------	1. 9	. 11	. 10	--------	67	23
7. 4	8. 0	3. 51	. 275	12. 8	1. 34	12. 9	38. 3	. 4	--------	1	--------	64
7. 4	8. 4	2. 37	. 167	14. 2	. 76	6. 7	48. 9	. 4	--------	1	--------	81
7. 6	8. 5	. 90	. 076	11. 8	. 68	13. 5	28. 7	. 4	--------	1	--------	55
7. 9	8. 7	. 43	. 037	11. 6	. 77	21. 3	12. 9	. 3	--------	2	--------	35
7. 6	8. 3	3. 09	. 227	13. 6	. 8	10. 0	22. 8	. 30	1. 62	1	--------	51
7. 5	8. 0	2. 31	. 196	11. 8	. 8	11. 3	21. 9	. 33	. 90	2	--------	43
7. 6	8. 2	1. 83	. 132	13. 9	. 8	7. 2	16. 9	. 21	. 58	1	--------	36
7. 7	8. 6	. 56	--------	--------	. 4	5. 8	5. 3	. 37	. 32	7	--------	24
7. 6	8. 1	1. 16	. 104	11. 2	1. 28	--------	24. 5	. 5	1. 86	2	--------	66
7. 5	8. 8	. 64	. 064	10. 0	. 85	1. 2	26. 7	1. 3	1. 97	5	--------	53
8. 1	9. 6	. 38	. 042	9. 0	1. 16	20. 5	23. 2	3. 3	1. 15	14	--------	62
8. 5	9. 9	. 24	. 031	7. 7	2. 44	39. 6	21. 8	6. 0	1. 14	27	--------	100
8. 3	9. 5	. 23	--------	--------	8. 06	32. 4	22. 4	6. 9	1. 08	33	--------	93
8. 2	9. 4	. 24	--------	--------	9. 00	27. 2	24. 4	7. 4	1. 21	30	--------	98
8. 5	9. 3	. 20	--------	--------	11. 97	23. 0	24. 1	7. 4	1. 36	37	--------	100
7. 8	8. 7	. 87	. 099	8. 8	1. 42	14. 7	31. 2	. 82	4. 85	3	--------	51
7. 8	8. 5	. 76	. 089	8. 5	. 48	16. 5	33. 3	. 81	6. 64	2	--------	62
7. 9	9. 3	. 39	. 056	7. 0	. 48	30. 7	26. 5	1. 57	6. 59	6	--------	56
8. 2	9. 5	. 36	--------	--------	1. 47	34. 4	26. 3	9. 39	7. 21	36	--------	60
8. 3	9. 7	. 24	--------	--------	. 69	36. 7	28. 2	8. 78	5. 49	31	--------	49
8. 3	9. 6	. 14	--------	--------	. 85	29. 2	30. 2	8. 95	5. 67	30	--------	57
6. 6	7. 5	1. 26	. 105	12. 0	. 78	--------	15. 8	. 19	1. 87	--------	83	29
6. 7	7. 5	. 82	. 070	11. 7	. 45	--------	16. 9	. 20	1. 55	--------	88	34
6. 3	7. 1	. 45	--------	--------	. 31	--------	. 9	. 22	. 90	--------	81	36
5. 9	7. 0	. 49	--------	--------	. 18	--------	23. 8	. 23	. 53	--------	77	39

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[3] Insufficient sample.

[4] Values were estimated. Fragments greater than 3 inches in diameter were discarded from sample.

Methods of Analysis

All samples were air-dried in the laboratory. Then, they were sieved by hand through the use of sieves 8 inches in diameter with round openings 2 millimeters in diameter. Samples that appeared to have no significant amount of pebbles or stones (less than 5 percent) were poured through a mechanical crusher that has openings of about 4 millimeters. Samples that had significant amounts of pebbles or stones were broken up in an iron mortar without crushing the pebbles or stones. If it was necessary to reduce the size of the sample, a Riffle sampler was used. Each laboratory sample was mixed thoroughly to insure uniformity, and all subsequent analyses were made on the fraction less than 2 millimeters in diameter. The percentage of material greater than 2 millimeters in diameter was calculated by dividing the weight of the fraction retained on the 2 millimeter sieve by the initial weight of the air-dry sample. Using a porcelain mortar and pestle, the subsamples less than 2 millimeters in diameter were ground small enough to pass a sieve having openings 0.3 millimeter in size. These subsamples were used to determine the organic carbon and calcium carbonate equivalent.

The official pipette method of analysis was used to determine particle-size distribution. Organic matter was destroyed by using hydrogen peroxide, but lime was not removed, except where specifically stated in the survey. Sodium hexametaphosphate was used as a dispensing agent. The sand fractions were determined by mechanical sieving through a series of sieves 2 inches in diameter. Except for glassware, all equipment used in making the analyses was furnished by the Soil Survey Laboratory at Beltsville, Md. The pipette method of analysis was used on the materials less than 2 millimeters in diameter. The amount of material larger than 2 millimeters is expressed on the basis of the total weight of the air-dry sample; the amount of sand, silt, and clay is expressed on the basis of the ovendry materials.

The moisture percentage at 15 atmospheres was determined by using the pressure membrane apparatus. Soil samples were placed in retaining rings 1 centimeter in depth and allowed to absorb water for at least 16 hours. Then, they were brought to equilibrium at the 15 atmosphere differential. Moisture is expressed as a percentage of the ovendry sample.

The reaction, or pH, was measured with a line-operated pH meter by using a glass electrode with a calomel reference electrode. In determining the pH of soil-water suspensions in the ratio of 1 to 5, the suspensions were stirred vigorously immediately before the electrodes were inserted. At the first indication of stabilization, the pH was read; then, the process was repeated until duplicate readings were obtained. Distilled water, or water free of carbon dioxide, was used for all soil-water suspensions.

The wet oxidation method using chromic acid was used to determine the content of organic carbon. Samples were heated during the oxidation process as described in the U.S. Department of Agriculture Handbook No. 60 (*9*). Silver sulfate was added to the sulfuric acid to prevent oxidation of chlorides for samples where soluble salts were 0.1 percent or more. After oxidation and dilution, an excess of ferrous ammonium sulfate was added to the sample, and the sample was then titrated with standard potassium permanganate. The permanganate also acted as an indicator, and a special titration light was used to help determine the exact endpoint.

The macro-Kjeldahl method was used to determine total nitrogen, with selinium as a catalyst. Enough water (about 15 to 20 milliliters) was added to the soil and other material in the flask to thoroughly wet the material before adding the acid for distillation. The distilled ammonia was caught in a boric acid solution of 2 percent that contained a special mixed indicator of bromcresol green and new coccine. The ammonia was then titrated with standard solution of $\frac{1}{14}$ N sulfuric acid, and the total amount of nitrogen was determined.

To determine the electrical conductivity of the saturation extract, a pipette cell with platinized platinum electrodes that had a cell constant of 0.5 was used along with a resistance bridge for measurement of EC_e. The pipette cell was equipped with a tapping key switch to avoid excessive flow of electric current, which could have heated the solution or polarized the electrodes. All values are expressed at 25° C.

To determine the calcium carbonate equivalent, the technician allowed variable weight of the sample to react in constant glass containers with 2 N hydrochloric acid. The percentage of calcium carbonate equivalent was determined by referring manometer readings to a curve prepared from standard samples of calcium carbonate.

In determining the cation-exchange capacity, samples of soil material less than 2 millimeters in diameter were saturated with sodium by four consecutive washings and centrifugations using 1 N sodium acetate solution that had been adjusted to pH 8.2. The soluble sodium acetate was removed by washing with a 95 percent solution of ethanol. The exchangeable sodium was then removed by three consecutive washings with neutral normal ammonium acetate. The amount of sodium was then measured on the flame photometer.

Extractable bases, sodium and potassium, are reported in table 8. Sodium was extracted by washing the sample three times with neutral, normal ammonium acetate, followed each time with centrifugation and filtering. The final extraction was at the ratio of 1 to 25. The amount of sodium in this extract was then measured using the flame photometer and lithium as the internal standard. Potassium was measured for the same extract and by the same method.

The exchangeable sodium percentage was derived by dividing the extractable sodium by the cation exchange capacity and multiplying the result by one hundred.

The base saturation percentage was determined by dividing the sum of extractable bases by the cation exchange capacity and multiplying the result by one hundred.

The moisture at saturation was obtained by drying a sample of the saturated paste mixed to meet saturation moisture criteria and determining the percent water.

Additional Facts About the Cache Area

This section describes the industries, community facilities, and settlement and development of the Cache Area. It also gives facts about the water supply, climate, and farming. Statistics for population and farming are from reports of the U.S. Bureau of the Census.

Industries

Several large industries have plants in the survey area. A sugar factory and a milk processing and canning plant are located in Lewiston. There is a large cheese factory in Amalga and a cheese packaging plant in Wellsville. A vegetable canning company is located in Smithfield. There are two meat packing plants located at Hyrum and one at Logan. Also located in Logan is a mobile home manufacturing concern, and a farm machinery company and a business form printing company are in the process of building plants near Logan. These and other industries offer seasonal employment, and many farmers supplement farm income with employment at these industries. Highway construction and building contractors, flour mills, and feed mixing plants offer employment in several communities. Utah State University also employs a large staff. Many people commute to defense and military establishments in adjacent Box Elder and Weber Counties.

Transportation

A main line of the Union Pacific Railroad enters Cache County through the gap where Bear River leaves the valley, passes through the towns of Newton and Cornish, and extends into Idaho. A spur line from Cache Junction serves the cities along the south and east sides of the valley.

From Brigham City and Salt Lake City to the south, U.S. Highways No. 899 and 91 enter the valley near Wellsville. At Logan the highways separate. U.S. Highway No. 89 extends east through Logan Canyon and U.S. Highway No. 91 extends north into Idaho. Paved State and county roads extend throughout the valley. The main paved road to the rangeland area passes through Blacksmith Fork Canyon to Hardware Ranch, where the road divides, and graded dirt roads extend northward and southward. Other dirt roads and trails cross the rangeland in the survey area.

The southern and eastern communities of the Cache Valley are served by natural gas. Electricity and culinary water are available in all rural and urban areas. Most of the culinary water comes from mountain springs and streams, but some communities supplement their supply with water from deep-pump wells.

Settlement and Development

The Indians of the region were Shoshoni. Before horses were acquired, they lived in primitive huts and subsisted on small game, birds, fish, berries, insects, and rodents. As horses became available, in 1750, the Indians rode in search of buffalo and other large game to supplement their diet. The buffalo hides also provided clothing and shelter.

John Weber's party of the Rocky Mountain Fur Company trapped beaver in the Cache Valley during the winter of 1824–25. Jim Bridger, a member of this party, followed the Bear River to its mouth and discovered Great Salt Lake. For several years he thought that he had reached the Pacific Ocean. Other trappers and explorers frequently passed through the valley. The valley became a popular place to cache furs before taking them east and also as a rendevous and supply point. This cache location is the origin of the name of Cache County.

On July 20, 1855, a company of Mormons with a large herd of cattle and horses arrived near the area where the town of Wellsville now stands. They were driven out by the severe winter that followed, but it marked the beginning of settlement. The next year, Wellsville was founded under the direction of Peter Maughan. Settlement of Providence, Mendon, Logan, Richmond, and Smithfield followed in 1859. These villages and others grew fast from the influx of Mormon converts and church members from the Salt Lake Valley.

Generally, the system of settlement was fort-style agricultural villages. Religious beliefs, community ties, and protection from Indian raids were largely responsible for this method of settlement. The city of Logan, having better irrigation facilities than other areas and having a more favorable location, grew rapidly and emerged as the business, educational, political, and religious center of Cache County. By 1890, Cache Valley had a population of 4,620. Banks, businesses, and industries began to prosper; almost every town was becoming self-sufficient, having churches, schools, general stores, banks, and mills. Under the Land Grant Act of 1888, the State of Utah authorized a college to be built at Logan; it is now Utah State University.

The campus of Utah State University is still located in Logan, and students can easily commute daily from towns in the survey area. Public elementary schools are available to all communities in the area. There are junior high schools in Hyrum, Logan, Richmond, and Lewiston. High schools are located in Smithfield and Logan.

The Logan Herald Journal is published daily in Logan. Two radio stations are in operation. Television is received from Salt Lake City. Utah State University also operates a radio and television station. Golf courses, movies, and swimming pools are available in the larger cities. Most communities have playgrounds and parks. Fishing is excellent in all streams and reservoirs. Hunting for upland game birds, waterfowl, deer, and elk is available in the area. Boating, water skiing, and facilities for other water sports are available on reservoirs in the area, as well as at Bear Lake. Beaver Mountain, in Logan Canyon, provides excellent skiing facilities.

Water Supply

Rainfall in the Cache Area is not adequate to produce maximum crop yields without supplemental water. Consequently, irrigation water is used wherever it is available. The first settlers started organized irrigation companies to construct diversions and canal systems. There are now about 45 of these mutual irrigation companies. Canals are mainly diversions from major streams. Since 1936, however, large reservoirs have been constructed in Cache County to irrigate additional acreage and to furnish a more dependable water supply. In 1936, Hyrum Dam was completed. The reservoir behind this dam has a capacity of 5,300 acre-feet and serves 2,225 acres. The latest reservoir to be completed is the Porcupine. It has a capacity of about 12,500 acre-feet and serves more than

2,500 acres. Additional reservoirs and canal systems are practicable and are being considered for construction in the future.

Many irrigation companies are lining their canals or are piping streams to conserve water and reduce maintenance. Sprinkler irrigation is replacing flood, furrow, or subirrigation methods on some farms to conserve water and increase efficiency.

Many areas of the Cache Valley are too wet for maximum crop production. On many farms in these areas, the soils are drained to lower the water table and to reduce the concentration of harmful salts in the root zone. Tile drains and open drains are used.

Climate[8]

In the Cache Area precipitation increases with elevation, and seasonal variations in precipitation are significant. In the farm areas of the Cache Valley, elevations range from 4,400 to 5,200 feet, and the average annual precipitation ranges from 16 to 20 inches. The mountains surrounding the valley rise to heights of more than 9,000 feet above sea level. Here, the average annual precipitation ranges from 20 to 35 inches. Rainfall is light in summer and is heaviest in spring. A considerable amount of the annual moisture is snow, most of which falls in the period from December through March. The average annual snowfall is between 60 and 80 inches in the Cache Valley and is as much as several hundred inches in the higher elevations.

Winters are cold but generally are not severe. In an average year, 6 to 12 days have a minimum temperature that is below zero and 35 to 40 days have a maximum that is 32° F. or below.

The daily temperature in summer ranges from a minimum in the 50's to a maximum in the 80's. Maximum temperatures of 90° or higher occur on an average of less than 25 days a year. Since temperatures were first recorded in 1891, a temperature of 100° or higher has been reported six times.

Winds generally are light, but winds from Logan and Blacksmith Fork Canyon sometimes reach a velocity of more than 80 miles per hour.

Thunderstorms sometimes occur in summer, but the amount of precipitation received usually is small. Hail is rare, and the stones generally are small. The frost-free period is about 7 days in the vicinity of Hardware Ranch and about 164 days at Utah State University in Logan. The growing season for most of the farming area in the Cache Valley ranges from 114 to 150 days. The growing season is slightly longer along the higher lake terraces and mountain foot slopes. The base of the temperature inversion at which the growing season is longest ranges from about 600 to 1200 feet above the valley floor. Tables 8 and 9 show the characteristics of temperature and precipitation in the Cache Area. Climatic data for Logan are based on a 71- to 76-year record; those for Lewiston are based on a 41-year record.

Farming

Most farming in the Cache Area is dairying and the raising of livestock. Farming is generally diversified, but livestock is raised on many farms so that pasture, hay, and grain can be used as feed for dairy and beef cattle. Sugar beets, peas, corn, and alfalfa are grown as cash crops. On nonirrigated farms wheat and barley are grown as cash crops.

Some apples, pears, sour cherries, and other fruits are grown in the survey area. Orchards are concentrated in the North to Providence area, where the hazard of frost is reduced by good air drainage. Smaller orchards and individual fruit trees are grown by farm families throughout the valley.

Soils on the lower terraces and on the floor of Cache Valley have several limitations to use for farming. The high water table and accumulations of salt and alkali limit the use of soils in these areas. The intensity of these limitations varies widely, as do the practices necessary for reclamation of the soils. Frost damage late in spring and early in fall is more likely in these areas than on higher terraces.

TABLE 8.—*Probability of last freezing temperature in spring and first in fall at Logan, Utah*

[Station at Utah State University]

Probability	Dates for stated probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 27	April 7	April 18	May 2	May 23
2 years in 10 later than	March 19	March 31	April 11	April 25	May 16
5 years in 10 later than	March 7	March 18	March 29	April 12	May 3
Fall:					
1 year in 10 earlier than	November 4	October 30	October 23	October 14	September 27
2 years in 10 earlier than	November 9	November 5	October 29	October 20	October 3
5 years in 10 earlier than	November 20	November 16	November 10	October 29	October 14

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[8] ARLO RICHARDSON, climatologist for Utah, National Weather Service, U.S. Department of Commerce, helped to prepare this section.

TABLE 9.—*Temperature and precipitation in the Cache Area, Utah*

LOGAN (UTAH STATE UNIVERSITY, ELEVATION 4,785 FEET)

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Days with snow cover	Average snowfall
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	° *F.*	° *F.*	° *F.*	° *F.*	*In.*	*In.*	*In.*	*Number*	*In.*
January	32. 3	15. 0	45	−6	1. 62	0. 65	2. 74	20	17. 1
February	37. 8	20. 1	50	−3	1. 49	. 61	2. 88	15	11. 3
March	46. 4	26. 4	61	14	1. 81	. 89	2. 61	9	10. 6
April	59. 2	36. 4	73	26	2. 09	. 77	3. 85	2	3. 3
May	73. 6	44. 2	83	35	1. 88	. 80	3. 18	(1)	4. 2
June	75. 7	50. 3	88	42	1. 51	. 44	3. 40	0	0
July	87. 6	58. 4	94	51	. 38	. 03	. 89	0	0
August	86. 0	57. 3	92	49	. 75	. 01	2. 25	0	0
September	76. 3	48. 5	86	39	1. 05	. 11	2. 18	0	(2)
October	63. 4	39. 6	76	30	1. 50	. 05	3. 07	1	1. 5
November	43. 8	27. 0	62	13	1. 71	. 44	3. 17	5	6. 5
December	36. 4	20. 7	48	8	1. 57	. 57	2. 36	14	11. 5
Year	59. 8	36. 9			17. 36			66	66. 0
LEWISTON, UTAH (ELEVATION 4,480 FEET)									
January	31. 7	9. 6	44	−8	1. 80	. 71	3. 26		17. 1
February	35. 3	15. 4	49	−10	1. 55	. 64	2. 58		11. 0
March	46. 1	22. 9	60	8	1. 73	. 62	2. 97		10. 4
April	59. 3	32. 3	73	23	1. 97	. 91	3. 57		3. 4
May	89. 6	39. 0	82	31	1. 98	. 50	3. 54		. 2
June	78. 2	44. 1	90	37	1. 69	. 49	3. 69		0
July	89. 4	49. 8	95	43	. 50	. 04	1. 45		0
August	87. 5	48. 0	94	40	. 88	(1)	1. 82		0
September	77. 5	39. 6	89	31	1. 05	. 06	2. 38		0
October	64. 6	31. 7	78	23	1. 49	. 04	3. 38		1. 0
November	45. 0	23. 0	59	18	1. 61	. 19	3. 41		4. 8
December	36. 1	16. 9	48	−2	1. 65	. 62	2. 91		12. 2
Year	60. 1	31. 0			17. 90				60. 1

[1] About one-half day.
[2] Trace.

The upper terraces and benches of the valley generally are better drained than other areas and are free of soluble salts. Frost damage is less likely in this area, particularly on the east side, than in other areas. The principal management needs are controlling erosion and improving the management of irrigation water.

The areas used for dryland crops are in the northwestern part of the Cache Valley. They extend along the western sides of the valley to the southwestern and southeastern parts. These areas generally are on high and medium terraces and on mountain foot slopes.

About 60 percent of the survey area is used for grazing by sheep and cattle. Much of the range vegetation has deteriorated since the area was settled. In recent years better methods of range management and increased use of chemical sprays on sagebrush and mulesear dock have greatly improved grass production on ranches in the Area.

The acreage of principal crops grown in Cache County for the year 1964 is as follows:

Crop	*Acres*
Corn, cut for silage	3, 616
Wheat, winter wheat harvested	31, 137
Wheat, spring wheat harvested	9, 635
Barley, harvested	26, 488
Oats, harvested	1, 416
Alfalfa hay	48, 015
Wild hay	3, 293
Alfalfa seed	1, 463
Irish potatoes	270
Sugar beets	4, 419
Sweet corn	870
Green peas	348
Apple trees (bushels)	144, 576
Pears (bushels)	3, 397
Cherries (pounds)	41, 475
Peaches (bushels)	1, 150

The Cache Area has large acreages of range and pasture. This acreage and the irrigated acreage of hay and other feed make efficient and extensive production of livestock possible. Herefords are the principal breed of beef cattle, but small herds of other breeds also are raised. Most of the calves from beef herds and the Holstein steers from the dairy herds are retained and fed in farm feedlots in the valley.

Most of the dairy herds are of the Holstein-Friesian breed. There also are a few herds of Jersey and Guernsey cattle. The milk is manufactured into cheese or condensed and canned milk or is marketed as whole milk. Some of the milk is shipped to markets as far away as Denver, Colorado, in refrigerated trucks.

Sheep are raised mainly for meat and wool. Most of the lambs are sold to feeders or packers outside the valley. Most herds are wintered on desert ranges in western Utah and eastern Nevada.

The kinds and numbers of livestock raised in Cache County in the year 1964 are as follows:

Livestock	*Number*
Cattle, including calves	49, 913
Dairy cows	13, 579
Hogs and pigs	2, 417
Sheep and lambs	30, 561
Chickens	76, 806
Turkeys	44, 175

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Border irrigation. See Irrigation.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Cemented (soil material). See Consistence, soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Drainage, soil. See Natural soil drainage.

Dryfarming. Production of crops that require some tillage in a subhumid or semiarid region, without irrigation. Usually involves use of periods of fallow, during which time enough moisture accumulates in the soil to allow production of a cultivated crop.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. Summer fallow is a common stage before cereal grain in regions of limited rainfall. The soil is tilled for at least one growing season to control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Furrow irrigation. See Irrigation.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Igneous rock. Rock that has been formed by the cooling of molten mineral material. Examples: Granite, syenite, diorite, and gabbro.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Lime. Chemically, lime is calcium oxide (CaO), but its meaning has been extended to include all limestone-derived materials applied to neutralize acid soils. Agricultural lime can be obtained as ground limestone, hydrated lime, or burned lime, with or without magnesium minerals. Basic slag, oystershells, and marl also contain calcium.

Mechanical analysis (soils). The percentage of the various sizes of individual mineral particles, or separates, in the soil. Also, a laboratory method of determining soil texture.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil and carbon, hydrogen, and oxygen obtained largely from the air and water, are plant nutrients.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range (rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land on which there are some forest trees.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and has a highly alkaline reaction; or contains harmful salts and exchangeable sodium and is strongly alkaline in reaction. The salts, exchangeable sodium, and alkaline reaction are so distributed in the soil in such locations that growth of most crop plants is significantly less than normal.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand), or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

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GUIDE TO MAPPING UNITS

Soils in the Cache Area were mapped at two intensities of detail. Those areas used mainly for farming were mapped at a high intensity of detail, and they are identified by map symbols composed of both uppercase and lowercase letters of the alphabet. The remaining soils, used mainly for range and as woodland, were mapped at a low intensity of detail. They are identified by map symbols composed entirely of uppercase letters. Dashes in columns headed Range site and Woodland suitability group mean the soil is used mainly for farming. For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. For complete information about a capability unit, refer to the subsection "Management by Capability Units" beginning on page 96. For information about Woodland suitability groups see pages 117 and 118. For information about Wildlife suitability groups see pages 119 and 120. Other information is given in tables as follows:

Acreage and extent, table 1, p. 8.
Predicted yields, table 2, p. 108.

Engineering uses of the soils, tables 3, 4, and 5, pp. 122 to 165.

			Capability unit Irrigated		Capability unit Nonirrigated		Range site		Woodland suitability group	Wildlife suitability group
Map symbol	Mapping unit	Page	Symbol	Page	Symbol	Page	Name	Page	Number	Number
AAE	Agassiz rocky silt loam, 6 to 30 percent slopes------------	7	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
AAG2	Agassiz rocky silt loam, 30 to 70 percent slopes, eroded----	10	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
ABG2	Agassiz-Bradshaw association, eroded------------------------	10								
	Agassiz soil----------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Bradshaw soil--------------	--	------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
ADG2	Agassiz-Dateman association, eroded-----------------------	10								
	Agassiz soil---------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Dateman soil---------------	--	------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4rl	4
AEG2	Agassiz-Elwood association, eroded-----------------------	10								
	Agassiz soil---------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Elwood soil----------------	--	------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4rl	4
AGE	Agassiz-Goring association-----	11								
	Agassiz soil---------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Goring soil----------------	--	------	---	VIe-M	105	Mountain Loam	112	------	3
AGG2	Agassiz-Goring association, eroded-----------------------	11								
	Agassiz soil---------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Goring soil----------------	--	------	---	VIIe-M	106	Mountain Loam	112	------	3
AhA	Airport silt loam, 0 to 3 percent slopes---------------	11	IVw-28	104	--------	---	Alkali Bottom	111	------	1
Ak	Airport silty clay loam--------	12	IVw-28	104	--------	---	Alkali Bottom	111	------	1
Am	Airport-Salt Lake complex------	12								
	Airport soil---------------	--	IVw-28	104	--------	---	Alkali Bottom	111	------	1
	Salt Lake soil-------------	--	IVw-28	104	--------	---	Wet Meadow	116	------	---
AND	Ant Flat loam, 6 to 20 percent slopes----------------------	13	------	---	VIe-M	105	Mountain Loam	112	------	3
AOE2	Ant Flat-Despain association, eroded-----------------------	13								
	Ant Flat soil--------------	--	------	---	VIe-M5	105	Mountain Clay	112	------	3
	Despain soil---------------	--	------	---	VIe-M	105	Mountain Loam	112	------	3
ArA	Avon silty clay loam, 0 to 3 percent slopes---------------	14	IIc-2	97	IIe-M	96	-----------------	---	------	3
ArB	Avon silty clay loam, 3 to 6 percent slopes---------------	14	IIe-2	96	IIe-M	96	-----------------	---	------	3

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Capability unit Irrigated Page	Capability unit Nonirrigated Symbol	Capability unit Nonirrigated Page	Range site Name	Range site Page	Woodland suitability group Number	Wildlife suitability group Number
ArC	Avon silty clay loam, 6 to 10 percent slopes---------------	15	IIIe-2	98	IIIe-M	98	Mountain Loam	112	------	3
ArD	Avon silty clay loam, 10 to 20 percent slopes---------------	15	IVe-2	102	IVe-M	103	Mountain Loam	112	------	3
AsC	Avon-Collinston complex, 6 to 10 percent slopes------------	15	IIIe-2	98	IIIe-M	98	Mountain Loam	112	------	3
AsE	Avon-Collinston complex, 10 to 30 percent slopes------------	15	------	----	IVe-M	103	Mountain Loam	112	------	3
BAF	Barfuss-Leatham association----	15								
	Barfuss soil---------------	--	------	----	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Leatham soil---------------	--	------	----	VIIe-U	106	Upland Loam	115	------	2
BcA	Battle Creek silty clay loam, 0 to 2 percent slopes--------	16	IIIs-25	102	IIIs-U5	102	-----------------	---	------	2
BcD	Battle Creek silty clay loam, 8 to 15 percent slopes-------	17	IVe-2	102	IVe-U5	103	-----------------	---	------	2
BGG	Bickmore gravelly silt loam, 30 to 70 percent slopes------	17	------	----	VIIe-HC	106	High Mountain Loam (Conifer)	112	4rl	4
BKG2	Bickmore-Agassiz association, eroded----------------------	18								
	Bickmore soil--------------	--	------	----	VIIe-HC	106	High Mountain Loam (Conifer)	112	4rl	4
	Agassiz soil---------------	--	------	----	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Picayune soil--------------	--	------	----	VIIe-M4	106	Mountain Loam	112	------	3
BLG2	Bickmore-Sheep Creek association, eroded----------	18								
	Bickmore soil--------------	--	------	----	VIIe-HC	106	High Mountain Loam (Conifer)	112	4rl	4
	Sheep Creek soil-----------	--	------	----	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Agassiz soil---------------	--	------	----	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
BmB	Blackrock gravelly loam, 3 to 6 percent slopes---------------	19	IIe-2	96	IIIe-UX	100	-----------------	---	------	2
BmC	Blackrock gravelly loam, 6 to 10 percent slopes------------	19	IIIe-2	98	IIIe-UXE	100	Upland Loam	115	------	2
BmD	Blackrock gravelly loam, 10 to 20 percent slopes------------	18	------	----	IVe-UX	104	Upland Loam	115	------	2
BnD	Blackrock extremely stony loam, 10 to 20 percent slopes------	19	------	----	VIIs-U4	107	Upland Stony Loam	115	------	2
BSG2	Bradshaw-Agassiz association, eroded-----------------------	19								
	Bradshaw soil--------------	--	------	----	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Agassiz soil---------------	--	------	----	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
Ca	Cache silty clay---------------	20	------	----	VIIIw-28	107	-----------------	--	------	1
Cd	Cardon silty clay--------------	20	IIIw-25	101	--------	---	Wet Meadow	116	------	1
CE	Center Creek silt loam---------	21	IIIw-3	101	--------	---	Wet Meadow	116	------	1
CFE	Clegg silt loam, 20 to 30 percent slopes---------------	22	------	----	VIe-MN	105	Mountain Loam (Shrubs)	112	------	3
CGE	Cluff silt loam, 6 to 30 percent slopes-----------------	23	------	----	VIe-HC	105	High Mountain Loam (Conifer)	112	4ol	4
CHE	Cluff-Lucky Star association--	23								
	Cluff soil-----------------	--	------	----	VIe-HC	105	High Mountain Loam (Conifer)	112	4ol	4
	Lucky Star soil------------	--	------	----	VIe-HA	104	High Mountain Loam (Aspen)	111	2ol	4
CIE	Cluff-Scout association-------	23	------	----	VIe-HC	105	High Mountain Loam (Conifer)	112	4ol	4
Ck	Collett silty clay loam------	24	IIIw-25	101	--------	---	Wet Meadow	116	------	1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Woodland suitability group Number	Wildlife suitability group Number
ClA	Collinston loamy fine sand, 0 to 3 percent slopes----------	25	IIIs-24	101	IIIs-U4	102	-----------------	---	------	2
CmC	Collinston loam, 1 to 6 percent slopes-----------------------	25	-------	---	IIIe-U	99	-----------------	---	------	2
CmD	Collinston loam, 6 to 10 percent slopes----------------	25	-------	---	IVe-U	103	-----------------	---	------	2
CmE2	Collinston loam, 10 to 30 percent slopes, eroded-------	25	-------	---	VIe-U	105	Upland Loam	115	------	2
CoA	Crookston loam, 0 to 3 percent slopes-----------------------	26	IIc-2	97	IIIe-U	99	-----------------	---	------	2
CoB	Crookston loam, 3 to 6 percent slopes-----------------------	26	IIe-2	96	IIIe-U	99	-----------------	---	------	2
CoC	Crookston loam, 6 to 10 percent slopes-----------------------	26	IIIe-2	98	IIIe-UE	100	-----------------	---	------	2
CrB	Crowshaw gravelly loam, 3 to 6 percent slopes---------------	27	IIe-2	96	IIIe-UX	100	-----------------	---	------	2
CrC	Crowshaw gravelly loam, 6 to 10 percent slopes---------------	27	IIIe-2	98	IIIe-UXE	100	-----------------	---	------	2
CrD	Crowshaw gravelly loam, 10 to 20 percent slopes------------	27	-------	---	IVe-UX	104	Upland Loam	115	------	2
CSE	Curtis Creek-Goring association, hilly-----------------------	27								
	Curtis Creek soil----------	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Goring soil----------------	--	-------	---	VIe-M	105	Mountain Loam	112	------	3
CSG	Curtis Creek-Goring association, steep-----------------------	28								
	Curtis Creek soil----------	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Goring soil----------------	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Lucky Star soil------------	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	------	3
DaC	Dagor silt loam, 4 to 8 percent slopes---------------	29	IIIe-2	98	IIIe-M	98	------------------	---	------	3
DaD	Dagor silt loam, 10 to 20 percent slopes---------------	28	IVe-2	102	IVe-M	103	------------------	---	------	3
DEG	Dateman extremely rocky silt loam, 40 to 80 percent slopes-----------------------	29	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4x1	4
DHG	Dateman-Bradshaw association---	29								
	Dateman soil---------------	--	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
	Bradshaw soil--------------	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
DLG	Datwyler cobbly silty clay loam, 30 to 60 percent slopes-	30	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
DNG	Datwyler-Elzinga-Maughan association------------------	30								
	Datwyler soil--------------		-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Elzinga soil---------------	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Maughan soil---------------	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
DPG	Despain-Bickmore association---	31								
	Despain soil---------------	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Bickmore soil--------------	--	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
DSG	Despain-Lucky Star association-	31								
	Despain soil---------------	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Lucky Star-----------------	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2r1	4

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit: Irrigated Symbol	Irrigated Page	Capability unit: Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Woodland suitability group Number	Wildlife suitability group Number
EDG	Elwood silt loam, 30 to 60 percent slopes	32	------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
EGE	Elwood-Agassiz association	32								
	Elwood soil	--	------	---	VIe-HC	105	High Mountain Loam (Conifer)	112	4o1	4
	Agassiz soil	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	-----	3
EME	Elwood-Mult association, hilly	32								
	Elwood soil	--	------	---	VIe-HC	105	High Mountain Loam (Conifer)	112	4o1	4
	Mult soil	--	------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
EMG	Elwood-Mult association, steep	32								
	Elwood soil	--	------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
	Mult soil	--	------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2r1	4
FGD	Fitzgerald extremely stony loam, 10 to 20 percent slopes	34	------	---	VIIs-HXC	106	High Mountain Loam (Conifer)	112	4x1	4
FLD	Flygare silt loam, 3 to 20 percent slopes	34	------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
FOG	Foxol rocky loam, 30 to 60 percent slopes	35	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
GGE	Goring silt loam, 6 to 30 percent slopes	35	------	---	VIe-M	105	Mountain Loam	112	------	3
GOE2	Goring-Obray association, eroded	36								
	Goring soil	--	------	---	VIe-M5	105	Mountain Clay	112	------	3
	Obray soil	--	------	---	VIe-M5	105	Mountain Clay	112	------	3
	Yeates Hollow soil	--	------	---	VIIs-MX5	107	Mountain Stony Clay	113	------	3
Gp	Gravel pit	36	------	---	VIIIs-4	107	----------------	---	------	---
GrA	Green Canyon gravelly loam, 0 to 3 percent slopes	37	IVs-24	104	VIs-U4	105	----------------	---	------	2
GrB	Green Canyon gravelly loam, 3 to 7 percent slopes	36	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
GsA	Greenson loam, 0 to 3 percent slopes	38	IIw-2	97	--------	---	----------------	---	------	1
GsB	Greenson loam, 3 to 6 percent slopes	38	IIw-2	97	--------	---	Semiwet Meadow	115	------	1
GsC	Greenson loam, 6 to 10 percent slopes	38	IIIe-2	98	--------	---	Semiwet Meadow	115	------	1
GuA	Greenson loam, deep over clay, 0 to 1 percent slopes	38	IIIw-25	101	--------	---	Wet Meadow	116	------	1
GvA	Greenson loam, deep over gravel, 0 to 1 percent slopes	38	IIw-2	97	--------	---	Semiwet Meadow	115	------	1
HdA	Hendricks silt loam, 1 to 3 percent slopes	39	IIc-2	97	IIe-M	96	----------------	---	------	3
HdB	Hendricks silt loam, 3 to 6 percent slopes	39	IIe-2	96	IIe-M	96	----------------	---	------	3
HdC	Hendricks silt loam, 6 to 10 percent slopes	39	IIIe-2	98	IIIe-M	98	----------------	---	------	3
HdD	Hendricks silt loam, 10 to 20 percent slopes	39	IVe-2	102	IVe-M	103	Mountain Loam	112	------	3
HeC	Hiibner gravelly clay loam, 3 to 10 percent slopes	40	-------	---	IIIe-MX5	99	Mountain Stony Clay	113	------	3

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit: Irrigated		Capability unit: Nonirrigated		Range site		Woodland suitability group	Wildlife suitability group
			Symbol	Page	Symbol	Page	Name	Page	Number	Number
HeD	Hiibner gravelly clay loam, 10 to 20 percent slopes	40	-------	---	IVe-MX5	103	Mountain Stony Clay	113	------	3
HeE	Hiibner gravelly clay loam, 20 to 30 percent slopes	41	-------	---	VIe-MX5	105	Mountain Stony Clay	113	------	3
HfE	Hiibner extremely stony clay loam, 1 to 30 percent slopes	40	-------	---	VIIs-MX5	107	Mountain Stony Clay	113	------	3
HgE2	Hillfield silt loam, 20 to 30 percent slopes, eroded	41	-------	---	VIe-U	105	Upland Loam	115	------	2
HhE2	Hillfield-Timpanogos silt loams, 10 to 30 percent slopes, eroded	41	-------	---	VIe-U	105	Upland Loam	115	------	2
HIB	Hoskin gravelly loam, thick surface, 1 to 6 percent slopes	43	-------	---	VIe-M	105	Mountain Loam	112	------	3
HKG2	Hoskin cobbly loam, 30 to 70 percent slopes, eroded	42	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
HLG2	Hoskin-Datwyler association, eroded	42	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
HMG2	Hoskin-Elzinga association, eroded	42								
	Hoskin soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Elzinga soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
HNG	Hoskin-Scave association	43								
	Hoskin soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Scave soil	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Ant Flat soil	--	-------	---	VIe-M	105	Mountain Loam	112	------	3
HOG2	Hoskin-Scout association, eroded	43								
	Hoskin soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Scout soil	--	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
HSG2	Hoskin-Smarts association, eroded	43								
	Hoskin soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Smarts soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
HuC	Hyrum gravelly loam, 4 to 8 percent slopes	44	-------	---	IIIe-UX	100	----------------	---	------	2
HuE	Hyrum gravelly loam, 10 to 25 percent slopes	44	-------	---	IVe-UX	104	Upland Stony Loam	115	------	2
HyC	Hyrum cobbly loam, 4 to 8 percent slopes	44	-------	---	IIIe-UX	100	Upland Stony Loam	115	------	2
Jo	Jordan silty clay loam	45	-------	---	VIIw-285	106	Alkali Bottom	111	------	1
Jr	Jordan-Lasil silty clay loams	44	-------	---	VIIw-285	106	Alkali Bottom	111	------	1
KdA	Kidman fine sandy loam, 0 to 2 percent slopes	46	IIc-2	97	--------	---	-----------------	---	------	2
KdD	Kidman fine sandy loam, 8 to 15 percent slopes	46	IVe-2	102	--------	---	-----------------	---	------	2

GUIDE TO MAPPING UNITS--Continued

			Capability unit				Range site		Woodland suitability group	Wildlife suitability group
			Irrigated		Nonirrigated					
Map symbol	Mapping unit	Page	Symbol	Page	Symbol	Page	Name	Page	Number	Number
KfA	Kidman fine sandy loam, deep water table, 0 to 2 percent slopes---------------	45	IIc-2	97	--------	---	----------------	---	------	2
KfB	Kidman fine sandy loam, deep water table, 2 to 4 percent slopes---------------	46	IIe-2	96	--------	---	----------------	---	------	2
KfC	Kidman fine sandy loam, deep water table, 4 to 8 percent slopes---------------	46	IIIe-2	98	--------	---	----------------	---	------	2
Ks	Kirkham-Shay complex-----------	46	IIw-2	97	--------	---	Semiwet Meadow	115	------	1
Kt	Kirkham-Shay complex, strongly alkali-----------------------	47	IVw-28	104	--------	---	Alkali Bottom	111	------	1
La	Lakewin gravelly coarse sandy loam------------------------	47	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
LCG	LaPlatta silty clay loam, 30 to 50 percent slopes---------	48	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
LGE	LaPlatta-Obray association-----	48								
	LaPlatta soil-------------	--	-------	---	VIe-MN	105	Mountain Loam (Shrubs)	112	------	3
	Obray soil-----------------	--	-------	---	VIe-M5	105	Mountain Clay	112	------	3
	Barfuss soil---------------	--	-------	---	VIIe-MN	106	----------------	---	------	3
Lh	Layton loamy fine sand---------	49	IIIs-24	101	--------	---	----------------	---	------	2
LMG2	Leatham-Barfuss association, eroded----------------------	50								
	Leatham soil---------------	--	-------	---	VIIe-U	106	Upland Loam	115	------	2
	Barfuss soil---------------	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
Ln	Lewiston fine sandy loam-------	51	IIw-26	97	--------	---	-----------------	---	------	2
Lo	Lewiston fine sandy loam, strongly alkali--------------	51	IVw-28	104	--------	---	Alkali Bottom	111	------	1
Lr	Logan silty clay loam----------	51	IIIw-25	101	--------	---	Wet Meadow	116	------	1
LSE	Lucky Star silt loam, 6 to 30 percent slopes---------------	53	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
LTG	Lucky Star gravelly silt loam, 30 to 60 percent slopes------	52	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2r1	4
LUE	Lucky Star-Goring association--	53								
	Lucky Star soil------------	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Goring soil----------------	--	-------	---	VIe-M	105	Mountain Loam	112	------	3
LVE	Lucky Star-Hoskin association--	53								
	Lucky Star soil------------	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Hoskin soil----------------	--	-------	---	VIe-M	105	Mountain Stony Loam	114	------	3
LWE	Lucky Star-Red Spur complex, 6 to 30 percent slopes---------	53	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
LXE	Lucky Star-Scout association---	53								
	Lucky Star soil------------	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Scout soil-----------------	--	-------	---	VIe-HC	105	High Mountain Loam (Conifer)	112	4o1	4
MAG	Maughan-Datwyler association---	54								
	Maughan soil---------------	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Datwyler soil--------------	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
McA	McMurdie silt loam, 0 to 3 percent slopes---------------	55	IIc-2	97	IIe-M	96	-----------------	---	------	3

Map symbol	Mapping unit	Page	Capability unit Irrigated		Capability unit Nonirrigated		Range site		Woodland suitability group	Wildlife suitability group
			Symbol	Page	Symbol	Page	Name	Page	Number	Number
McB	McMurdie silt loam, 3 to 6 percent slopes	54	IIe-2	96	IIe-M	96	----------------	---	------	3
McC	McMurdie silt loam, 6 to 10 percent slopes	55	IIIe-2	98	IIIe-M	98	----------------	---	------	3
MdE2	McMurdie-Hillfield silt loams, 10 to 30 percent slopes, eroded	55								
	McMurdie soil	--	-------	---	IVe-M	103	----------------	---	------	3
	Hillfield soil	--	-------	---	VIe-U	105	Upland Loam	115	------	2
MeA	Mendon silt loam, 0 to 3 percent slopes	57	IIc-2	97	IIe-M	96	----------------	---	------	3
MeB	Mendon silt loam, 3 to 6 percent slopes	56	IIe-2	96	IIe-M	96	----------------	---	------	3
MeC	Mendon silt loam, 6 to 10 percent slopes	57	IIIe-2	98	IIIe-M	98	----------------	---	------	3
MfB	Mendon-Collinston complex, 1 to 6 percent slopes	57	-------	---	IIIe-U	99	----------------	---	------	2
MfE2	Mendon-Collinston complex, 6 to 30 percent slopes, eroded	58	-------	---	VIe-U	105	Upland Loam	115	------	2
MlA	Millville silt loam, 0 to 2 percent slopes	60	IIw-2	97	--------	---	----------------	---	------	2
MlB	Millville silt loam, 2 to 4 percent slopes	59	IIe-2	96	--------	---	----------------	---	------	2
Mm	Mixed alluvial land	60	-------	---	Vw-2	104	Wet Meadow	116	------	1
MNE	Mult-Agassiz association	60								
	Mult soil	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2o1	4
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
MNG2	Mult-Agassiz association, eroded	61								
	Mult soil	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2o1	4
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
MoG2	Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded	61								
	Munk soil	--	-------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
	Blackrock soil	--	-------	---	VIIs-U4	107	Upland Loam	115	------	2
MSE	Mult-Lucky Star association	61								
	Mult soil	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Lucky Star soil	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
NbB	Nebeker silt loam, 3 to 6 percent slopes	63	IIe-2	96	IIe-M	96	-----------------	---	------	3
NbC	Nebeker silt loam, 6 to 10 percent slopes	63	IIIe-2	98	IIIe-M	98	-----------------	---	------	3
NbE	Nebeker silt loam, 10 to 25 percent slopes	62	-------	---	IVe-M	103	-----------------	---	------	3
NcA	Nibley silty clay loam, 0 to 3 percent slopes	63	IIIw-2	100	--------	---	Semiwet Meadow	115	------	1
NcB	Nibley silty clay loam, 3 to 6 percent slopes	63	IIIw-2	100	--------	---	-----------------	---	------	1
ObB	Obray silty clay, 1 to 6 percent slopes	64	-------	---	VIe-M5	105	Mountain Clay	112	------	3
PaA	Parleys silt loam, 0 to 3 percent slopes	65	IIc-2	97	IIIw-U	99	-----------------	---	------	2
PaB	Parleys silt loam, 3 to 6 percent slopes	65	IIe-2	96	IIIe-U	99	-----------------	---	------	2

GUIDE TO MAPPING UNITS--Continued

			Capability unit				Range site		Woodland suitability group	Wildlife suitability group
			Irrigated		Nonirrigated					
Map symbol	Mapping unit	Page	Symbol	Page	Symbol	Page	Name	Page	Number	Number
PaC	Parleys silt loam, 6 to 10 percent slopes	66	IIIe-2	98	IIIe-UE	100	----------------	---	------	2
PlA	Parlo silt loam, 0 to 3 percent slopes	66	IIc-2	97	IIIs-U4	102	----------------	---	------	2
PlB	Parlo silt loam, 3 to 6 percent slopes	66	IIe-2	96	IIIs-U4	102	----------------	---	------	2
PlC	Parlo silt loam, 6 to 10 percent slopes	66	-------	---	IIIe-UE	100	----------------	---	------	2
Pn	Payson silt loam	67	-------	---	VIIw-285	106	Alkali Bottom	111	------	1
POG2	Picayune-Agassiz association, eroded	67								
	Picayune soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
PRG	Picayune-Smarts association	68								
	Picayune soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Smarts soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
PSG2	Poleline-Agassiz association, eroded	69								
	Poleline soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
PtC	Preston fine sand, 0 to 10 percent slopes	69	IVs-24	104	--------	---	----------------	---	------	2
Pu	Provo loam	70	IIIw-2	100	--------	---	Wet Meadow	116	------	1
Pv	Provo gravelly loam	70	-------	---	Vw-2	104	Wet Meadow	116	------	1
Qu	Quinney silt loam	70	IIIw-28	101	--------	---	Alkali Bottom	111	------	1
RCG2	Richmond very stony loam, 30 to 70 percent slopes, eroded	72	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
RDG2	Richmond-Middle association, eroded	72								
	Richmond soil	--	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
	Middle soil	--	-------	---	VIIs-U4	107	Upland Loam	115	------	2
REG2	Richmond-Munk association, eroded	72								
	Richmond soil	--	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
	Munk soil	--	-------	---	VIIs-U4	107	Upland Stony Loam	115		2
RFG2	Richmond-Nebeker association, eroded	73								
	Richmond soil	--	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
	Nebeker soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Sterling soil	--	-------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
RGG2	Richmond-Sterling association, eroded	73								
	Richmond soil	--	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
	Sterling soil	--	------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
RhA	Ricks gravelly loam, 0 to 3 percent slopes	74	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
RhB	Ricks gravelly loam, 3 to 6 percent slopes	74	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
RhC	Ricks gravelly loam, 6 to 10 percent slopes	74	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
Rk	Riverwash	74	-------	---	VIIIw-4	107	-----------------	---	------	---
RO	Rock land	74	-------	---	VIIIs-X	107	-----------------	---	------	---
Rs	Roshe Springs silt loam	75	IIIw-2	100	--------	---	Wet Meadow	116	------	1
Rt	Rough broken land	76	-------	---	VIIe-U	106	Upland Loam	115	------	2

GUIDE TO MAPPING UNITS--Continued

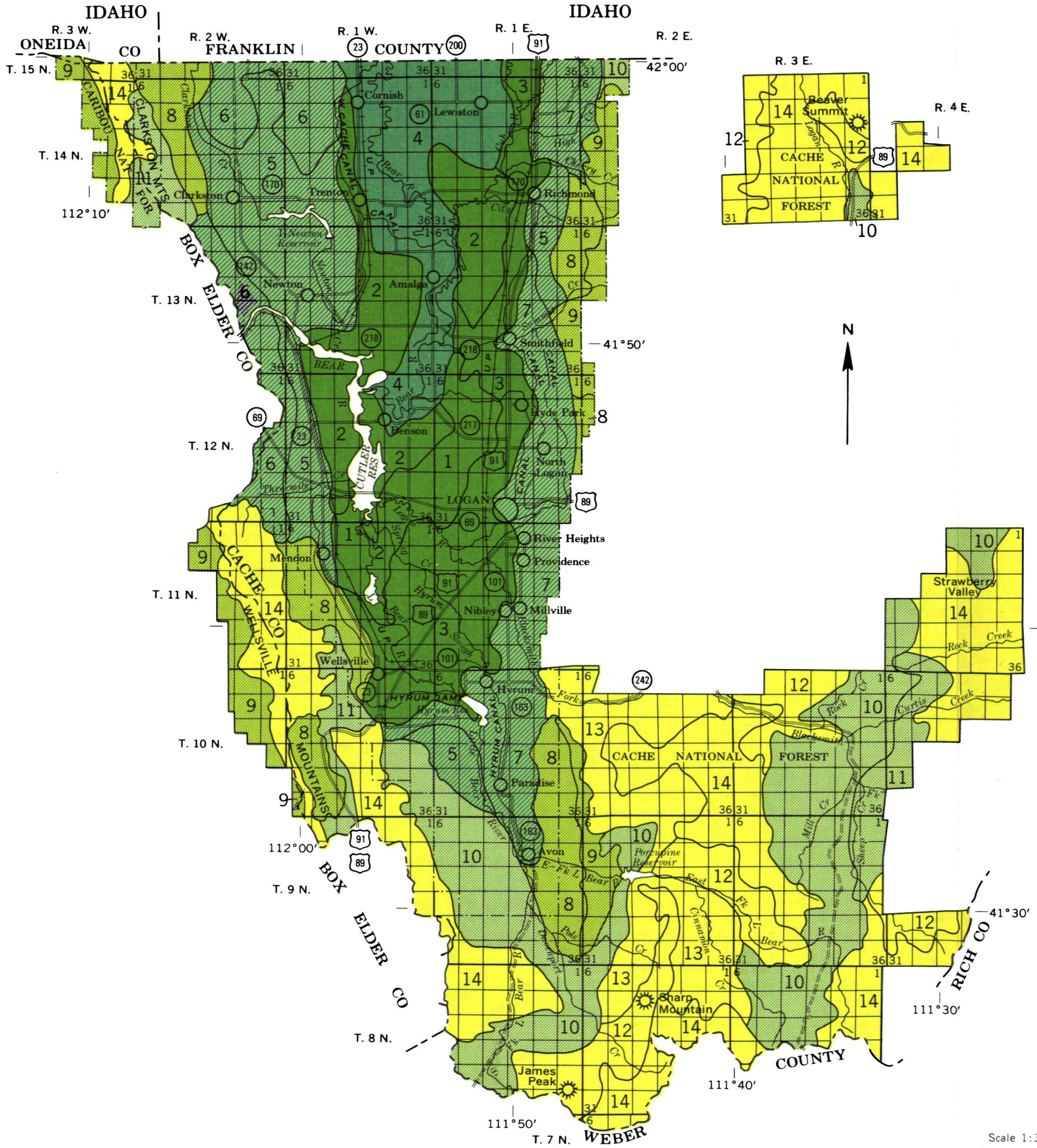
			Capability unit				Range site		Woodland suitability group	Wildlife suitability group
			Irrigated		Nonirrigated					
Map symbol	Mapping unit	Page	Symbol	Page	Symbol	Page	Name	Page	Number	Number
SAG	St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes	76	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
SCG	St. Marys-Curtis Creek association	77								
	St. Marys soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Curtis Creek soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
Sd	Salt Lake silty clay loam	77	IIIw-25	101	--------	---	Wet Meadow	116	------	1
Se	Salt Lake silty clay	77	-------	---	Vw-2	104	Wet Meadow	116	------	1
Sf	Salt Lake-Logan complex	78	IIIw-25	101	--------	---	Wet Meadow	116	------	1
Sg	Salt Lake-Roshe Springs complex	78	-------	---	Vw-2	104	Wet Meadow	116	------	1
Sh	Salt Lake-Trenton complex	78	-------	---	--------	---	----------------	---	------	---
	Salt Lake soil	--	-------	---	Vw-2	104	Wet Meadow	116	------	1
	Trenton soil	--	-------	---	Vw-2	104	Alkali Bottom	111	------	1
SIE	Scave silt loam, 10 to 30 percent slopes	78	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
SKE	Scave extremely rocky silt loam, 10 to 30 percent slopes	79	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	------	4
SLG	Scout gravelly loam, 40 to 70 percent slopes	80	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
Sm	Shay silty clay loam	80	IIIw-25	101	--------	---	Semiwet Meadow	115	------	1
SNG2	Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded	81	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
SOG2	Sheep Creek-Agassiz association, eroded	81								
	Sheep Creek soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
SPG2	Sheep Creek-Despain association, eroded	81								
	Sheep Creek soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Despain soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
SRG2	Sheep Creek-Maughan association, eroded	81								
	Sheep Creek soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Maughan soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
SSE	Smarts silt loam, 10 to 30 percent slopes	82	-------	---	VIe-M	105	Mountain Loam (Shrubs)	112	------	3
STG2	Smarts-Hoskin association, eroded	82								
	Smarts soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Haskins soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Capability unit Irrigated Page	Capability unit Nonirrigated Symbol	Capability unit Nonirrigated Page	Range site Name	Range site Page	Woodland suitability group Number	Wildlife suitability group Number
SUG	Smarts-Lucky Star-Poleline association	83								
	Smarts soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Lucky Star soil	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2r1	4
	Poleline soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
SvA	Steed gravelly loam, 0 to 3 percent slopes	84	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SvB	Steed gravelly loam, 3 to 6 percent slopes	84	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SvC	Steed gravelly loam, 6 to 10 percent slopes	84	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SwC	Sterling gravelly loam, 6 to 10 percent slopes	85	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SwD	Sterling gravelly loam, 10 to 20 percent slopes	85	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SwF2	Sterling gravelly loam, 20 to 50 percent slopes, eroded	85	-------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
Sy	Stony alluvial land	85	-------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
TmA	Timpanogos silt loam, 0 to 3 percent slopes	86	IIc-2	97	IIIe-U	99	-----------------	---	------	2
TmB	Timpanogos silt loam, 3 to 6 percent slopes	86	IIe-2	96	IIIe-U	99	-----------------	---	------	2
TmC	Timpanogos silt loam, 6 to 10 percent slopes	86	IIIe-2	98	IIIe-UE	100	-----------------	---	------	2
TmD2	Timpanogos silt loam, 10 to 20 percent slopes, eroded	86	IVe-2	102	IVe-U	103	Upland Loam	115	------	2
TnA	Timpanogos silt loam, deep water table, 0 to 3 percent slopes	87	IIc-2	97	--------	---	-----------------	---	------	2
TrA	Trenton silty clay loam, 0 to 2 percent slopes	87	IVw-28	104	IIIs-U8	102	Alkali Bottom	111	------	1
TrB	Trenton silty clay loam, 2 to 4 percent slopes	88	IVw-28	104	IIIs-U8	102	Alkali Bottom	111	------	1
TrC	Trenton silty clay loam, 4 to 8 percent slopes	88	IVw-28	104	IIIs-U8	102	Alkali Bottom	111	------	1
TrD2	Trenton silty clay loam, 8 to 20 percent slopes, eroded	88	-------	---	IVe-U8	103	Alkali Bottom	111	------	1
TtA	Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes	88	IVw-28	104	--------	---	Alkali Bottom	111	------	1
WhE	Wheelon silt loam, 10 to 30 percent slopes	89	-------	---	VIe-U1	105	Upland Shallow Loam	115	------	2
WhF2	Wheelon silt loam, 30 to 50 percent slopes, eroded	89	-------	---	VIIe-U1	106	Upland Shallow Loam	115	------	2
W1E2	Wheelon-Collinston complex, 10 to 30 percent slopes, eroded	89								
	Wheelon soil	--	-------	---	VIe-U1	105	Upland Shallow Loam	115	------	2
	Collinston soil	--	-------	---	VIe-U1	105	Upland Loam	115	------	2
Wn	Winn silt loam	89	IIIw-2	100	--------	---	Semiwet Meadow	115	------	1
Wp	Winn-Provo complex	90	IIIw-2	100	--------	---	Semiwet Meadow	115	------	1
Wr	Woods Cross silty clay loam	90	IIIw-25	101	--------	---	Wet Meadow	116	------	1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Woodland suitability group Number	Wildlife suitability group Number
YHE	Yeates Hollow extremely rocky silt loam, 6 to 30 percent slopes-----------------------	91	-------	---	VIIs-MX4	107	Mountain Stony Loam	114	------	3
YHG	Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes-----------------------	91	-------	---	VIIs-MX4	107	Mountain Stony Loam	114	------	3
YLE2	Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded-------	92	-------	---	VIIs-MX5	107	Mountain Stony Clay	113	------	3



Scale 1:316,800

1 0 1 2 3 4 5 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL ASSOCIATIONS

MODERATELY WELL DRAINED TO POORLY DRAINED SOILS OF THE LOW LAKE TERRACES

1	Logan-Salt Lake association: Poorly drained, nearly level soils that have a silty clay loam and silty clay underlying layer
2	Trenton association: Strongly saline and alkali, somewhat poorly drained and moderately well drained, nearly level to sloping soils that have a silty clay subsoil
3	Greenson-Nibley-Collett association: Dominantly somewhat poorly drained, nearly level to gently sloping soils that have a loam to silty clay subsoil or underlying layer

WELL-DRAINED TO SOMEWHAT POORLY DRAINED SOILS OF THE MEDIUM LAKE TERRACES

4	Kidman-Lewiston association: Nearly level to gently sloping soils that are fine sandy loam throughout

WELL-DRAINED SOILS OF THE MEDIUM AND HIGH LAKE TERRACES

5	Mendon-Avon association: Nearly level to strongly sloping soils that have a clay loam and silty clay subsoil
6	Wheelon-Collinston association: Moderately steep to very steep soils that have a loam, silt loam, and clay loam underlying layer
7	Ricks-Timpanogos-Parleys association: Nearly level and strongly sloping soils that have a gravelly loam, gravelly sandy loam, loam, and clay loam subsoil

WELL-DRAINED SOILS OF THE UPLANDS

8	Nebeker-Hendricks association: Strongly sloping to moderately steep soils that have a silty clay loam and clay subsoil
9	Richmond-Sterling-Picayune association: Somewhat excessively drained soils that have gravelly loam or gravelly sandy loam underlying layers or a gravelly clay loam subsoil

WELL-DRAINED AND SOMEWHAT EXCESSIVELY DRAINED SOILS OF THE MOUNTAINS

10	Yeates Hollow-Ant Flat-Goring association: Sloping to very steep soils that have a silty clay, clay, and very cobbly clay subsoil
11	Sheep Creek-Hoskin-Curtis Creek association: Steep and very steep soils that have a gravelly and cobbly loam to clay loam subsoil

WELL-DRAINED AND SOMEWHAT EXCESSIVELY DRAINED SOILS OF THE HIGH MOUNTAINS

12	Agassiz-Rock outcrops association: Very steep, stony soils that are silt loam and stony silty clay loam throughout, and rock outcrops
13	Dateman-Agassiz-Bradshaw association: Steep and very steep soils that are cobbly or very cobbly silt loam and silty clay loam throughout or have a cobbly loam subsoil
14	Lucky Star-Cluff-Bickmore association: Moderately steep and steep soils that have a very cobbly sandy clay loam, gravelly clay, and cobbly silty clay loam subsoil

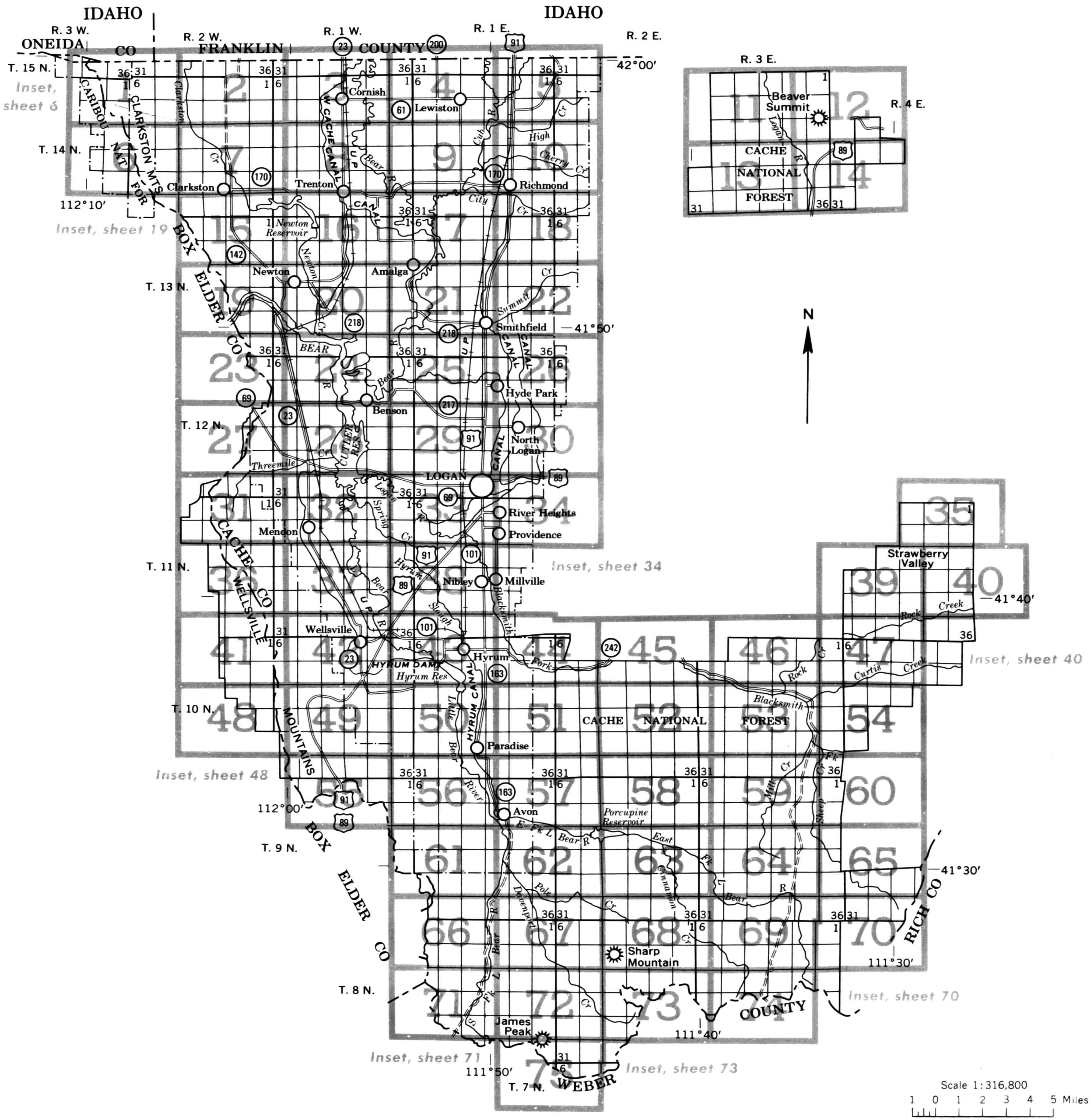
Compiled 1971

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

UTAH AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

CACHE VALLEY AREA, UTAH
PARTS OF CACHE AND BOX ELDER COUNTIES



INDEX TO MAP SHEETS

CACHE VALLEY AREA, UTAH

PARTS OF CACHE AND BOX ELDER COUNTIES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES

U. S. FOREST SERVICE
UTAH AGRICULTURAL EXPERIMENT STATION

SOIL LEGEND

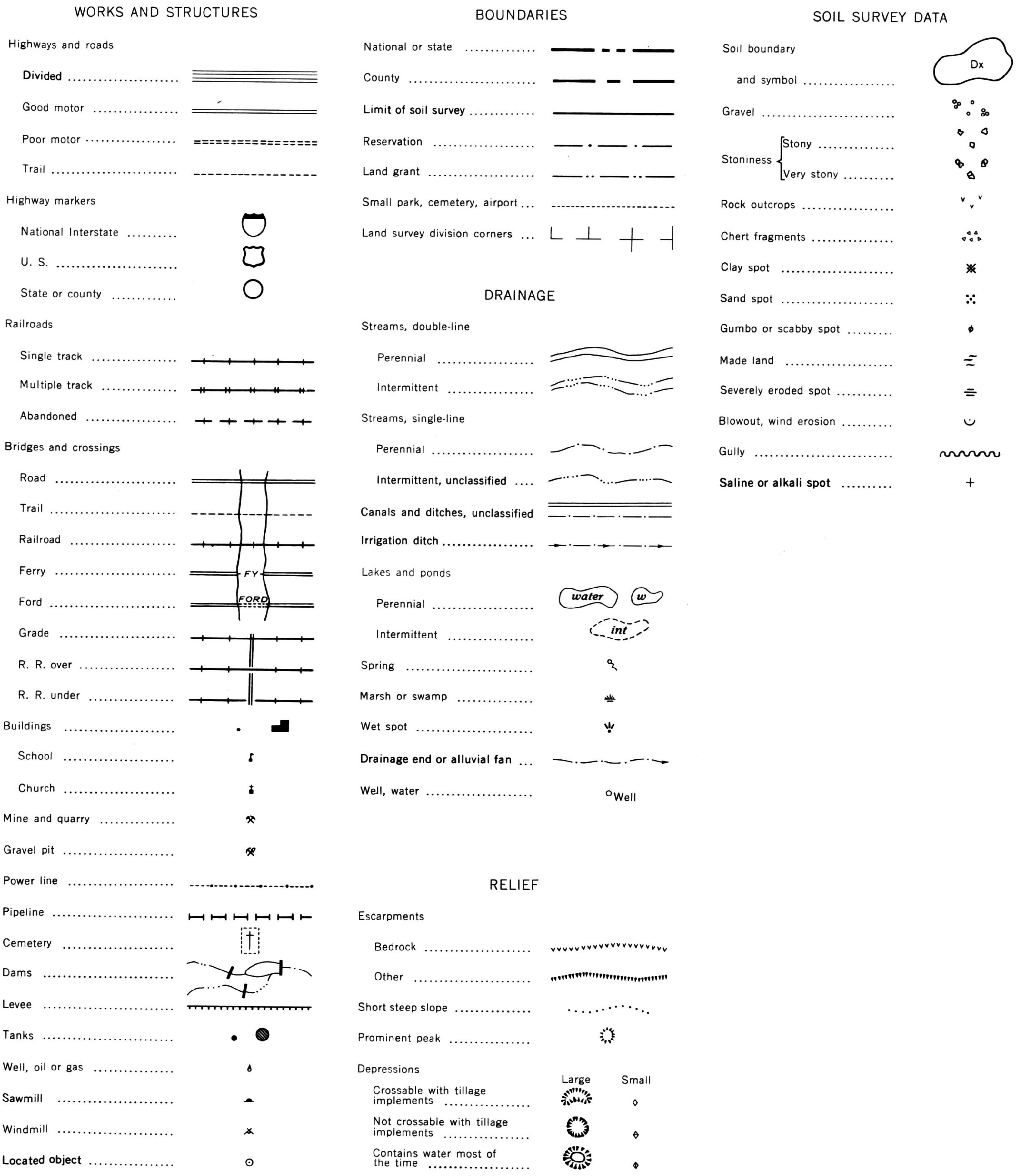
The first letter, always a capital, is the initial one of the soil name. The second letter is a capital if the mapping unit is one of the low intensity survey *; otherwise, it is a small letter. The third letter, always a capital, A, B, C, D, E, F, or G, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 2, in the symbol shows that the soil is eroded.

HIGH AND MEDIUM INTENSITY	LOW INTENSITY	
SYMBOL		NAME
–	AAE	Agassiz rocky silt loam, 6 to 30 percent slopes
–	AAG2	Agassiz rocky silt loam, 30 to 70 percent slopes, eroded
–	ABG2	Agassiz-Bradshaw association, eroded
–	ADG2	Agassiz-Dateman association, eroded
–	AEG2	Agassiz-Elwood association, eroded
–	AGE	Agassiz-Goring association
–	AGG2	Agassiz-Goring association, eroded
AhA	–	Airport silt loam, 0 to 3 percent slopes
Ak	–	Airport silty clay loam
Am	–	Airport-Salt Lake complex
–	AND	Ant Flat loam, 6 to 20 percent slopes
–	AOE2	Ant Flat-Despain association, eroded
ArA	–	Avon silty clay loam, 0 to 3 percent slopes
ArB	–	Avon silty clay loam, 3 to 6 percent slopes
ArC	–	Avon silty clay loam, 6 to 10 percent slopes
ArD	–	Avon silty clay loam, 10 to 20 percent slopes
AsC	–	Avon-Collinston complex, 6 to 10 percent slopes
AsE	–	Avon-Collinston complex, 10 to 30 percent slopes
–	BAF	Barfuss-Leatham association
BcA	–	Battle Creek silty clay loam, 0 to 2 percent slopes
BcD	–	Battle Creek silty clay loam, 8 to 15 percent slopes
–	BGG	Bickmore gravelly silt loam, 30 to 70 percent slopes
–	BKG2	Bickmore-Agassiz association, eroded
–	BLG2	Bickmore-Sheep Creek association, eroded
BmB	–	Blackrock gravelly loam, 3 to 6 percent slopes
BmC	–	Blackrock gravelly loam, 6 to 10 percent slopes
BmD	–	Blackrock gravelly loam, 10 to 20 percent slopes
BnD	–	Blackrock extremely stony loam, 10 to 20 percent slopes
–	BSG2	Bradshaw-Agassiz association, eroded
Ca	–	Cache silty clay
Cd	–	Cardon silty clay
–	CE	Center Creek silt loam
–	CFE	Clegg silt loam, 20 to 30 percent slopes
–	CGE	Cluff silt loam, 6 to 30 percent slopes
–	CHE	Cluff-Lucky Star association
–	CIE	Cluff-Scout association
Ck	–	Collett silty clay loam
ClA	–	Collinston loamy fine sand, 0 to 3 percent slopes
CmC	–	Collinston loam, 1 to 6 percent slopes
CmD	–	Collinston loam, 6 to 10 percent slopes
CmE2	–	Collinston loam, 10 to 30 percent slopes; eroded
CoA	–	Crookston loam, 0 to 3 percent slopes
CoB	–	Crookston loam, 3 to 6 percent slopes
CoC	–	Crookston loam, 6 to 10 percent slopes
CrB	–	Crowshaw gravelly loam, 3 to 6 percent slopes
CrC	–	Crowshaw gravelly loam, 6 to 10 percent slopes
CrD	–	Crowshaw gravelly loam, 10 to 20 percent slopes
–	CSE	Curtis Creek-Goring association, hilly
–	CSG	Curtis Creek-Goring association, steep
DaC	–	Dagor silt loam, 4 to 8 percent slopes
DaD	–	Dagor silt loam, 10 to 20 percent slopes
–	DEG	Dateman extremely rocky silt loam, 40 to 80 percent slopes
–	DHG	Dateman-Bradshaw association
–	DLG	Datwyler cobbly silty clay loam, 30 to 60 percent slopes
–	DNG	Datwyler-Elzinga-Maughan association
–	DPG	Despain-Bickmore association
–	DSG	Despain-Lucky Star association
–	EDG	Elwood silt loam, 30 to 60 percent slopes
–	EGE	Elwood-Agassiz association
–	EME	Elwood-Mult association, hilly
–	EMG	Elwood-Mult association, steep
–	FGD	Fitzgerald extremely stony loam, 10 to 20 percent slopes
–	FLD	Flygare silt loam, 3 to 20 percent slopes
–	FOG	Foxol rocky loam, 30 to 60 percent slopes
–	GGE	Goring silt loam, 6 to 30 percent slopes
–	GOE2	Goring-Obray association, eroded
Gp	–	Gravel pit
GrA	–	Green Canyon gravelly loam, 0 to 3 percent slopes
GrB	–	Green Canyon gravelly loam, 3 to 7 percent slopes
GsA	–	Greenson loam, 0 to 3 percent slopes
GsB	–	Greenson loam, 3 to 6 percent slopes
GsC	–	Greenson loam, 6 to 10 percent slopes
GuA	–	Greenson loam, deep over clay, 0 to 1 percent slopes
GvA	–	Greenson loam, deep over gravel, 0 to 1 percent slopes
HdA	–	Hendricks silt loam, 1 to 3 percent slopes
HdB	–	Hendricks silt loam, 3 to 6 percent slopes
HdC	–	Hendricks silt loam, 6 to 10 percent slopes
HdD	–	Hendricks silt loam, 10 to 20 percent slopes
HeC	–	Hiibner gravelly clay loam, 3 to 10 percent slopes
HeD	–	Hiibner gravelly clay loam, 10 to 20 percent slopes
HeE	–	Hiibner gravelly clay loam, 20 to 30 percent slopes
HfE	–	Hiibner extremely stony clay loam, 1 to 30 percent slopes
HgE2	–	Hillfield silt loam, 20 to 30 percent slopes, eroded
HhE2	–	Hillfield-Timpanogos silt loams, 10 to 30 percent slopes, eroded
–	HIB	Hoskin gravelly loam, thick surface, 1 to 6 percent slopes
–	HKG2	Hoskin cobbly loam, 30 to 70 percent slopes, eroded
–	HLG2	Hoskin-Datwyler association, eroded
–	HMG2	Hoskin-Elzinga association, eroded
–	HNG	Hoskin-Scave association
–	HOG2	Hoskin-Scout association, eroded
–	HSG2	Hoskin-Smarts association, eroded
HuC	–	Hyrum gravelly loam, 4 to 8 percent slopes
HuE	–	Hyrum gravelly loam, 10 to 25 percent slopes
HyC	–	Hyrum cobbly loam, 4 to 8 percent slopes
Jo	–	Jordan silty clay loam
Jr	–	Jordan-Lasil silty clay loams
KdA	–	Kidman fine sandy loam, 0 to 2 percent slopes
KdD	–	Kidman fine sandy loam, 8 to 15 percent slopes
KfA	–	Kidman fine sandy loam, deep water table, 0 to 2 percent slopes
KfB	–	Kidman fine sandy loam, deep water table, 2 to 4 percent slopes
KfC	–	Kidman fine sandy loam, deep water table, 4 to 8 percent slopes
Ks	–	Kirkham-Shay complex
Kt	–	Kirkham-Shay complex, strongly alkali
La	–	Lakewin gravelly coarse sandy loam
–	LCG	LaPlatta silty clay loam, 30 to 50 percent slopes
–	LGE	LaPlatta-Obray association
Lh	–	Layton loamy fine sand
–	LMG2	Leatham-Barfuss association, eroded
Ln	–	Lewiston fine sandy loam
Lo	–	Lewiston fine sandy loam, strongly alkali
Lr	–	Logan silty clay loam
–	LSE	Lucky Star silt loam, 6 to 30 percent slopes
–	LTG	Lucky Star gravelly silt loam, 30 to 60 percent slopes
–	LUE	Lucky Star-Goring association
–	LVE	Lucky Star-Hoskin association
–	LWE	Lucky Star-Red Spur complex, 6 to 30 percent slopes
–	LXE	Lucky Star-Scout association
–	MAG	Maughan-Datwyler association
McA	–	McMurdie silt loam, 0 to 3 percent slopes
McB	–	McMurdie silt loam, 3 to 6 percent slopes
McC	–	McMurdie silt loam, 6 to 10 percent slopes
MdE2	–	McMurdie-Hillfield silt loams, 10 to 30 percent slopes, eroded
MeA	–	Mendon silt loam, 0 to 3 percent slopes
MeB	–	Mendon silt loam, 3 to 6 percent slopes
MeC	–	Mendon silt loam, 6 to 10 percent slopes
MfB	–	Mendon-Collinston complex, 1 to 6 percent slopes
MfE2	–	Mendon-Collinston complex, 6 to 30 percent slopes, eroded
MlA	–	Millville silt loam, 0 to 2 percent slopes
MlB	–	Millville silt loam, 2 to 4 percent slopes
Mm	–	Mixed alluvial land
–	MNE	Mult-Agassiz association
–	MNG2	Mult-Agassiz association, eroded
MoG2	–	Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded
–	MSE	Mult-Lucky Star association
NbB	–	Nebeker silt loam, 3 to 6 percent slopes
NbC	–	Nebeker silt loam, 6 to 10 percent slopes
NbE	–	Nebeker silt loam, 10 to 25 percent slopes
NcA	–	Nibley silty clay loam, 0 to 3 percent slopes
NcB	–	Nibley silty clay loam, 3 to 6 percent slopes
ObB	–	Obray silty clay, 1 to 6 percent slopes
PaA	–	Parleys silt loam, 0 to 3 percent slopes
PaB	–	Parleys silt loam, 3 to 6 percent slopes
PaC	–	Parleys silt loam, 6 to 10 percent slopes
PlA	–	Parlo silt loam, 0 to 3 percent slopes
PlB	–	Parlo silt loam, 3 to 6 percent slopes
PlC	–	Parlo silt loam, 6 to 10 percent slopes
Pn	–	Payson silt loam
–	POG2	Picayune-Agassiz association, eroded
–	PRG	Picayune-Smarts association
–	PSG2	Poleline-Agassiz association, eroded
PtC	–	Preston fine sand, 0 to 10 percent slopes
Pu	–	Provo loam
Pv	–	Provo gravelly loam
Qu	–	Quinney silt loam
–	RCG2	Richmond very stony loam, 30 to 70 percent slopes, eroded
–	RDG2	Richmond-Middle association, eroded
–	REG2	Richmond-Munk association, eroded
–	RFG2	Richmond-Nebeker association, eroded
–	RGG2	Richmond-Sterling association, eroded
RhA	–	Ricks gravelly loam, 0 to 3 percent slopes
RhB	–	Ricks gravelly loam, 3 to 6 percent slopes
RhC	–	Ricks gravelly loam, 6 to 10 percent slopes
Rk	–	Riverwash
–	RO	Rock land
Rs	–	Roshe Springs silt loam
Rt	–	Rough broken land
–	SAG	St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes
–	SCG	St. Marys-Curtis Creek association
Sd	–	Salt Lake silty clay loam
Se	–	Salt Lake silty clay
Sf	–	Salt Lake-Logan complex
Sg	–	Salt Lake-Roshe Springs complex
Sh	–	Salt Lake-Trenton complex
–	SIE	Scave silt loam, 10 to 30 percent slopes
–	SKE	Scave extremely rocky silt loam, 10 to 30 percent slopes
–	SLG	Scout gravelly loam, 40 to 70 percent slopes
Sm	–	Shay silty clay loam
–	SNG2	Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded
–	SOG2	Sheep Creek-Agassiz association, eroded
–	SPG2	Sheep Creek-Despain association, eroded
–	SRG2	Sheep Creek-Maughan association, eroded
–	SSE	Smarts silt loam, 10 to 30 percent slopes
–	STG2	Smarts-Hoskin association, eroded
–	SUG	Smarts-Lucky Star-Poleline association
SvA	–	Steed gravelly loam, 0 to 3 percent slopes
SvB	–	Steed gravelly loam, 3 to 6 percent slopes
SvC	–	Steed gravelly loam, 6 to 10 percent slopes
SwC	–	Sterling gravelly loam, 6 to 10 percent slopes
SwD	–	Sterling gravelly loam, 10 to 20 percent slopes
SwF2	–	Sterling gravelly loam, 20 to 50 percent slopes, eroded
Sy	–	Stony alluvial land
TmA	–	Timpanogos silt loam, 0 to 3 percent slopes
TmB	–	Timpanogos silt loam, 3 to 6 percent slopes
TmC	–	Timpanogos silt loam, 6 to 10 percent slopes
TmD2	–	Timpanogos silt loam, 10 to 20 percent slopes, eroded
TnA	–	Timpanogos silt loam, deep water table, 0 to 3 percent slopes
TrA	–	Trenton silty clay loam, 0 to 2 percent slopes
TrB	–	Trenton silty clay loam, 2 to 4 percent slopes
TrC	–	Trenton silty clay loam, 4 to 8 percent slopes
TrD2	–	Trenton silty clay loam, 8 to 20 percent slopes, eroded
TtA	–	Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes
WhE	–	Wheelon silt loam, 10 to 30 percent slopes
WhF2	–	Wheelon silt loam, 30 to 50 percent slopes, eroded
WlE2	–	Wheelon-Collinston complex, 10 to 30 percent slopes, eroded
Wn	–	Winn silt loam
Wp	–	Winn-Provo complex
Wr	–	Woods Cross silty clay loam
–	YHE	Yeates Hollow extremely rocky silt loam, 6 to 30 percent slopes
–	YHG	Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes
–	YLE2	Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded

* The composition of these units is more variable than that of the others in the survey area but has been controlled well enough to interpret for the expected use of the soils.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES

CONVENTIONAL SIGNS



WORKS AND STRUCTURES

- Highways and roads
  - Divided
  - Good motor
  - Poor motor
  - Trail
- Highway markers
  - National Interstate
  - U. S.
  - State or county
- Railroads
  - Single track
  - Multiple track
  - Abandoned
- Bridges and crossings
  - Road
  - Trail
  - Railroad
  - Ferry
  - Ford
  - Grade
  - R. R. over
  - R. R. under
- Buildings
  - School
  - Church
- Mine and quarry
- Gravel pit
- Power line
- Pipeline
- Cemetery
- Dams
- Levee
- Tanks
- Well, oil or gas
- Sawmill
- Windmill
- Located object

BOUNDARIES

- National or state
- County
- Limit of soil survey
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

- Streams, double-line
  - Perennial
  - Intermittent
- Streams, single-line
  - Perennial
  - Intermittent, unclassified
- Canals and ditches, unclassified
- Irrigation ditch
- Lakes and ponds
  - Perennial
  - Intermittent
- Spring
- Marsh or swamp
- Wet spot
- Drainage end or alluvial fan
- Well, water

RELIEF

- Escarpments
  - Bedrock
  - Other
- Short steep slope
- Prominent peak
- Depressions (Large, Small)
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Contains water most of the time

SOIL SURVEY DATA

- Soil boundary
  - and symbol
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Saline or alkali spot

SOIL SURVEY OF

Cache Valley Area, Utah

Parts of Cache and Box Elder Counties

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
Utah Agricultural Experiment Station

Issued November 1974

Major fieldwork for this soil survey was done in the period of 1959–64. Soil names and descriptions were approved in 1968. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Utah Agricultural Experiment Station. It is part of the technical assistance furnished to the Blacksmith Fork and North Cache Soil Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

Locating Soils

All the soils of the Cache Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site, woodland suitability group, and wildlife suitability group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitations of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, range sites, and woodland suitability groups.

Foresters and others can refer to the section "Use of the Soils as Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in the Cache Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given in the section "Additional Facts About the Cache Area" and also at the beginning of the publication.

***Cover:* Sugar beets on Hendricks silt loam, 1 to 3 percent slopes. Wasatch Mountains are in the background.**

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Contents

Page

How this survey was made 1

General soil map 2

Moderately well drained to poorly drained soils of the low lake terraces 3

1. Logan-Salt Lake association 3
2. Trenton association 3
3. Greenson-Nibley-Collett association 3

Well-drained to somewhat poorly drained soils of the medium lake terraces 3

4. Kidman-Lewiston association 3

Well-drained soils of the medium and high lake terraces 4

5. Mendon-Avon association 4
6. Wheelon-Collinston association 4
7. Ricks-Timpanogos-Parleys association 4

Well-drained soils of the uplands 5

8. Nebeker-Hendricks association 5
9. Richmond-Sterling-Picayune association 5

Well-drained and somewhat excessively drained soils of the mountains 5

10. Yeates Hollow-Ant Flat-Goring association 5
11. Sheep Creek-Hoskin-Curtis Creek association 6

Well-drained and somewhat excessively drained soils of the high mountains 6

12. Agassiz association 6
13. Dateman-Agassiz-Bradshaw association 6
14. Lucky Star-Cluff-Bickmore association 7

Descriptions of the Soils 7

Agassiz series 7
Airport series 11
Ant Flat series 13
Avon series 14
Barfuss series 15
Battle Creek series 16
Bickmore series 17
Blackrock series 18
Bradshaw series 19
Cache series 20
Cardon series 20
Center Creek series 21
Clegg series 22
Cluff series 23
Collett series 24
Collinston series 24
Crookston series 25
Crowshaw series 26
Curtis Creek series 27
Dagor series 28
Dateman series 29
Datwyler series 30
Despain series 30
Elwood series 31
Elzinga series 33
Fitzgerald series 33
Flygare series 34
Foxol series 35
Goring series 35
Gravel pit 36
Green Canyon series 36
Greenson series 37
Hendricks series 39
Hiibner series 40
Hillfield series 41
Hoskin series 41
Hyrum series 43
Jordan series 44
Kidman series 45
Kirkham series 46

Page

Descriptions of the Soils—Continued

Lakewin series 47
LaPlatta series 48
Lasil series 49
Layton series 49
Leatham series 50
Lewiston series 50
Logan series 51
Lucky Star series 52
Maughan series 53
McMurdie series 54
Mendon series 56
Middle series 59
Millville series 59
Mixed alluvial land 60
Mult series 60
Munk series 61
Nebeker series 62
Nibley series 63
Obray series 64
Parleys series 65
Parlo series 66
Payson series 67
Picayune series 67
Poleline series 68
Preston series 69
Provo series 69
Quinney series 70
Red Spur series 71
Richmond series 72
Ricks series 73
Riverwash 74
Rock land 74
Roshe Springs series 75
Rough broken land 76
St. Marys series 76
Salt Lake series 77
Scave series 78
Scout series 79
Shay series 80
Sheep Creek series 80
Smarts series 82
Steed series 84
Sterling series 84
Stony alluvial land 85
Timpanogos series 85
Trenton series 87
Wheelon series 88
Winn series 89
Woods Cross series 90
Yeates Hollow series 91

Use and management of the soils for crops 92

General management for crops on irrigated soils 92
General management for crops on nonirrigated soils 94
Capability grouping 95
  Management by capability units 96
Estimated yields 107

Use of the soils for range 110

Range sites and condition classes 110
Climatic zones and their effect on range 110
Descriptions of range sites 111

Use of the soils as woodland 116

Woodland management and woodland suitability groups 116

Use of the soils for wildlife 119

Kinds of wildlife and their habitat 120

Engineering uses of the soils 120

Engineering classification systems 121

CONTENTS

Page
Engineering uses of the Soils—Continued
Estimated engineering properties 121
Engineering interpretations 166
Engineering test data 167
Formation and classification of the soils 167
Factors of soil formation 167
Parent material 167
Climate 168
Relief 169
Plants and animals 170
Time 171
Classification of the soils 172
Laboratory analyses 175
Methods of analysis 186
Additional facts about the Cache Area 186
Industries 187
Transportation 187
Settlement and development 187
Water supply 187
Climate 188
Farming 188
Literature cited 190
Glossary 190
Guide to mapping units Following 192

Issued November 1974

SOIL SURVEY OF CACHE VALLEY AREA, UTAH

PARTS OF CACHE AND BOX ELDER COUNTIES

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FIELDWORK BY VEAR L. MORTENSEN, LUDENE B. CAMPBELL, SHERMAN G. STOCK, HOWARD A. STOKES, EARL H. JENSEN, BLAINE G. MOLYNEAUX, JAMES A. CARLEY, MARVIN L. BARNEY, AND RICHARD L. THOMPSON, SOIL CONSERVATION SERVICE, AND DONALD BOYER, DEVON NELSON, AND DAVID H. CROCKETT, FOREST SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH THE UTAH AGRICULTURAL EXPERIMENT STATION

THE CACHE VALLEY AREA: PARTS OF CACHE AND BOX ELDER COUNTIES (called the Cache Area in this soil survey) is in the northern part of Utah and consists of about 813 square miles or 520,162 acres. It includes all of Cache County except about 230,000 acres of the Cache National Forest in the northeastern part of the county. It also includes about 17,000 acres of Box Elder County on the west slopes of Clarkston and Wellsville Mountains (fig. 1).

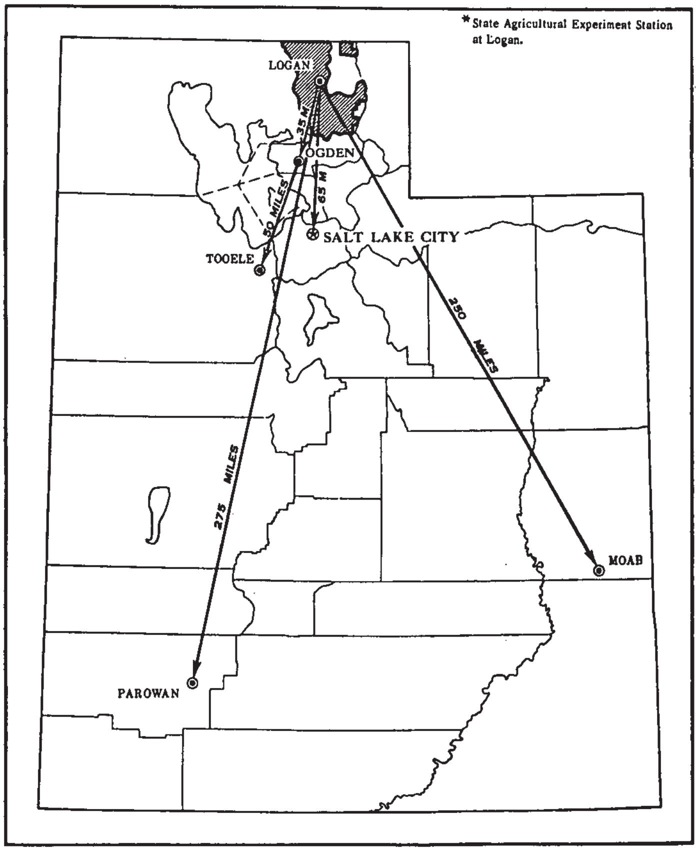

Figure 1.—Location of the Cache Valley Area in Utah.

This is an important farming area. It consists of about 123,000 acres of irrigated cropland, 116,525 acres of nonirrigated cropland or pasture, and 280,802 acres of range and woodland.

Cache County consists essentially of Cache Valley and its surrounding drainage area. Geologically, the valley is a graben at the eastern margin of the Basin and Range province between the northernmost element of the Wasatch Range, Wellsville Mountain, and the southern extension of the Malad Range. Clarkston Mountain is on the west, and the Bear River Range is on the east (*12*).[1]

The major part of the Cache Valley is at elevations between 4,400 and 5,200 feet. Height of the mountains included in the survey area ranges to nearly 10,000 feet.

The Bear River is the largest stream flowing into the survey area. It enters the valley from Idaho, west of Lewiston, Utah, runs south to the vicinity of Benson, then west into Box Elder County and into Great Salt Lake. The source of the Logan River is in the Franklin Basin. The Logan River enters Cache Valley east of the city of Logan. The source of the Little Bear River is in the extreme southern end of the county. The Blacksmith Fork River and its tributaries drain a large area from the east and southeast. Other smaller streams head in the mountains that border Cache Valley. The Bear River serves as a drainage for all these streams before it leaves Cache Valley toward Great Salt Lake. Most of the streams have cut deep channels through the lake terraces.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Cache Area, where they are located, and how they can be used. The soil scientists went into the survey area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

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[1] Italic numbers in parentheses refer to Literature Cited, p. 190.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in areas nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soils series* and the *soil phase* (*8*) are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Logan and Mendon, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Trenton silty clay loam, 2 to 4 percent slopes, is one of several phases within the Trenton series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of the Cache Area: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Airport-Salt Lake complex.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort needed for mapping them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Agassiz-Goring association is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Mixed alluvial land is a land type in the Cache Area.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Cache Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The 14 soil associations in the Cache Area are discussed in the following pages. For more detailed information about the individual soils in each association, refer to the detailed map and to the section "Descriptions of the Soils."

Moderately Well Drained to Poorly Drained Soils of the Low Lake Terraces

Soils of this group are moderately well drained to poorly drained, but they are dominantly somewhat poorly drained and poorly drained. They formed in mixed lake sediment and alluvium derived mainly from limestone, sandstone, and quartzite. These soils have a loam to silty clay subsoil. They are nearly level or gently sloping (slopes range from 0 to 3 percent) and are on low lake terraces and alluvial fans at elevations of 4,420 to 4,700 feet. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days.

Three of the associations in the Cache Area are in this group. They make up about 18 percent of the survey area.

1. Logan-Salt Lake association

Poorly drained, nearly level soils that have a silty clay loam and silty clay underlying layer

This association consists of soils on valley bottoms. It extends from southeast of Mendon to a point west of the city of Logan and southwest of Smithfield. The association makes up about 4 percent of the survey area.

Logan soils occupy about 40 percent of the association, and Salt Lake soils about 30 percent. Airport, Greenson, Cardon, and Collett soils and Salt Lake, gypsum variant, soils occupy the remaining 30 percent.

The Logan soils are poorly drained or very poorly drained, and they are strongly calcareous. The surface layer is silty clay loam that is black or very dark gray when moist. The material underlying the surface layer is silty clay loam and silty clay. The Salt Lake soils are poorly drained or very poorly drained, and they are very strongly calcareous. The surface layer is silty clay that is black or very dark gray when moist. The material underlying the surface layer is silty clay. The Airport, Collett, and Greenson soils generally are on slightly higher terraces than the other soils.

The soils of this association are used mainly for native pasture or for meadow from which hay is cut. The vegetation is mostly sedges, wiregrass, foxtail, and saltgrass, In the swales, where the water table is highest, there are cattails and bulrushes.

2. Trenton association

Strongly saline and alkali, somewhat poorly drained and moderately well drained, nearly level to sloping soils that have a silty clay subsoil.

This association is located in two areas. One of these is between the town of Richmond and the Bear River. The other area is between the towns of Benson and Petersboro, north nearly to the town of Trenton, with a narrow arm that extends as far as Cornish. The association makes up about 6 percent of the survey area.

Trenton soils are dominant in this association and occupy about 80 percent of the association. Cache, Jordan, Payson, and Lasil soils make up the remaining 20 percent. These soils generally are on lower terraces than the Trenton soils.

The Trenton soils are somewhat poorly drained and moderately well drained, and they are strongly affected by salt and alkali. The surface layer is silty clay loam, and the subsoil is silty clay.

Most areas of the Trenton soils in this association are cultivated. When irrigation water is available, alfalfa, small grain, sugar beets, and improved pasture are important crops. Dryland areas are used for alfalfa and small grain. Where these soils are not cultivated, the vegetation consists mainly of saltgrass, alkali sacaton, western wheatgrass, Great Basin wildrye, gumweed, sagebrush, and greasewood.

3. Greenson-Nibley-Collett association

Dominantly somewhat poorly drained, nearly level to gently sloping soils that have a loam to silty clay subsoil or underlying layer

This association is in areas near the towns of Wellsville, College Ward, and Hyrum and in a narrow band west of the cities of Logan, Smithfield, and Richmond that extends to the Idaho line. The association makes up about 8 percent of the survey area.

Greenson soils occupy about 40 percent of this association, Nibley soils about 30 percent, and Collett soils about 15 percent. Roshe Springs and Millville soils occupy the remaining 15 percent.

The Greenson soils are somewhat poorly drained and moderately well drained. They are loam or silt loam throughout. The Nibley and Collett soils are somewhat poorly drained. They have a silty clay loam surface layer and a heavy silty clay loam and silty clay subsoil.

The soils of this association are used mainly for irrigated crops of alfalfa, small grain, corn for silage, sugar beets, and improved pasture. Small areas are used for dryland crops of alfalfa and small grain. Where these soils are adequately drained, they are well suited to crops. Where the soils are not cultivated, the vegetation consists mainly of western wheatgrass, saltgrass, foxtail, alkali sacaton, and some areas of sedges and wiregrass.

Well-drained to Somewhat Poorly Drained Soils of the Medium Lake Terraces

Soils of this group are dominantly moderately well drained and somewhat poorly drained, but some are well drained. They have a fine sandy loam subsoil. These soils formed in mixed alluvium and lake sediment derived mainly from limestone, sandstone, and quartzite rocks. They are nearly level and gently sloping and are at elevations of 4,430 to 4,550 feet. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 50° F., and the frost-free season is 130 to 150 days.

Only one association in the Cache Area is in this group. It covers about 6 percent of the survey area.

4. Kidman-Lewiston association

Nearly level to gently sloping soils that are fine sandy loam throughout

This association is near the towns of Lewistown and Cornish and in the area south to the town of Benson. It makes up about 6 percent of the survey area.

Kidman soils occupy about 45 percent of the association, and Lewiston soils about 35 percent. Quinney, Layton, and Preston soils occupy the remaining 20 percent.

The Kidman soils are moderately well drained and well drained. The surface layer and subsoil are fine sandy loam. The Lewiston soils are somewhat poorly drained. The texture is fine sandy loam throughout. The water table is at a depth of about 20 to 40 inches. The subsoil and substratum of the Lewiston soils are strongly affected by salt and alkali.

The soils in this association are used for irrigated crops of alfalfa, small grain, sugar beets, corn for silage, and improved pasture. When the water table is controlled, these soils are well suited to crops. Where the soils are not cultivated, the vegetation consists mainly of bluebunch wheatgrass, western wheatgrass, foxtail, saltgrass, and sagebrush.

Well-drained Soils of the Medium and High Lake Terraces

Soils of this group are dominantly well drained and have a loam to silty clay subsoil. These soils are nearly level to very steep and occupy lake terraces, alluvial fans, deltas, and terrace escarpments. The Mendon, Avon, Wheelon, and Collinston soils formed in material derived from the Salt Lake geologic formation and contain an appreciable amount of volcanic ash. The Ricks, Timpanogos, Parleys, and McMurdie soils formed in mixed alluvium and lake sediment derived mainly from limestone, quartzite, and sandstone. Elevation ranges from about 4,500 to 5,300 feet. The average annual precipitation is 15 to 20 inches, the mean annual air temperature is 45° to 50° F., and the frost-free season is 110 to 160 days.

Three of the associations in the Cache Area are in this group. They make up about 19 percent of the survey area.

5. *Mendon-Avon association*

Nearly level to strongly sloping soils that have a clay loam and silty clay subsoil

This association is in three separate areas. The largest of these is near the towns of Clarkston and Newton and extends south to Mendon. Another area is located south of Hyrum Dam, and a third is in the vicinity of the city of Richmond. The association makes up about 8 percent of the survey area.

Mendon soils occupy about 50 percent of the association, and Avon soils occupy about 30 percent. Crookston and Collinston soils, and small areas of Hyrum and Blackrock soils, make up the remaining 20 percent.

All of these soils formed in reworked lake sediment derived from rocks of the Salt Lake Formation. In most places the surface layer is black or dark gray when moist. The Mendon soils are well drained. They have a silt loam surface layer and a clay loam subsoil. Avon soils also are well drained. They have a silty clay loam surface layer and a silty clay subsoil.

The soils of this association are used mainly for nonirrigated crops, but near the towns of Newton, Mendon, and Richmond, much of the acreage is irrigated. The irrigated crops are alfalfa, sugar beets, barley, wheat, corn for silage, and pasture. Where these soils are not cultivated, the vegetation consists mainly of western wheatgrass, bluebunch wheatgrass, balsamroot, and big sagebrush.

6. *Wheelon-Collinston association*

Moderately steep to very steep soils that have a loam, silt loam, and clay loam underlying layer

This association is in two areas. The major one of these is between the towns of Cornish and Clarkston and extends north to the Idaho line. The other area is a narrow band on the extreme west side of the Cache Valley from Clarkston south to the town of Mendon. This association makes up about 4 percent of the survey area.

Wheelon and Collinston soils are about equal in extent and occupy 85 percent of the association. Mendon, Munk and Blackrock soils make up the remaining 15 percent.

The Wheelon soils are well drained, and they are strongly calcareous. The silt loam surface layer is light olive brown when moist. The subsoil is silt loam. The Collinston soils are well drained, and they are strongly calcareous. The silt loam surface layer is dark gray when moist. The subsoil ranges from loam to clay.

The soils of this association are better suited to range than to cultivated crops. They are suitable for reseeding to adapted grasses. Some of the more gently sloping areas are suited to dryfarmed crops. The vegetation consists mainly of bluebunch wheatgrass, prairie junegrass, Great Basin wildrye, balsamroot, aster, buckwheat, geranium, and sagebrush.

7. *Ricks-Timpanogos-Parleys association*

Nearly level and strongly sloping soils that have a gravelly loam, gravelly sandy loam, loam, and clay loam subsoil

This association consists of soils in a narrow band, 2 to 3 miles wide, that extends from the town of Paradise on the south, through the cities of Hyrum, Logan, and Smithfield, and north to the Idaho line. The association occupies about 7 percent of the survey area.

Ricks and Timpanogos soils each occupy about 25 percent of the association, and Parleys and McMurdie soils each occupy about 15 percent. Sterling, Steed, Green Canyon, and Hillfield soils make up the remaining 20 percent.

The Ricks soils are mainly on old river deltas and terraces. They are well drained to somewhat excessively drained. The surface layer is gravelly loam, and the subsoil is sandy loam and gravelly loam. The substratum is very gravelly sand. The Timpanogos soils are well drained. The surface layer is silt loam, and the subsoil is loam. The Parleys soils are well drained and have a silt loam surface layer and a dominantly clay loam subsoil.

The soils of this association are used mostly for cultivated crops. Most areas are irrigated and are used for alfalfa, small grain, corn, peas, beans, orchards, and improved pasture. Nonirrigated areas are used for alfalfa and small grain. Where these soils are not cultivated, the vegetation is mainly bluebunch wheatgrass, balsamroot, buckwheat, and sagebrush.

Well-drained Soils of the Uplands

This group consists of two soil associations. The soils in these associations are similiar in drainage and general location, but they have some contrasting soil characteristics and vary somewhat in position and climate.

The Nebeker-Hendrick association consists of well-drained soils that have a silty clay loam and clay subsoil. The soils are mainly strongly sloping to moderately steep and are on broad alluvial fans above the upper lake terraces. Elevation ranges from 4,800 to 5,700 feet. These soils formed in alluvium and colluvium derived chiefly from sandstone and quartzite rocks. The average annual precipitation is 16 to 20 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 110 to 140 days.

The Richmond-Sterling-Picayune association consists of somewhat excessively drained very gravelly and stony loams and sandy loams. These soils are on very steep terrace escarpments, deltas, and foot slopes of mountains. Elevation ranges from 5,200 to 7,500 feet. The average annual precipitation is 15 to 20 inches, the average annual air temperature is 42° to 48° F., and the frost-free season is 90 to 120 days.

The associations in this group make up about 11 percent of the survey area.

8. *Nebeker-Hendricks association*

Strongly sloping to moderately steep soils that have a silty clay loam or clay subsoil

This association consists of soils in six areas: (1) northwest of the town of Clarkston, (2) west and south from the town of Mendon, (3) the Dry Lake area, (4) east of the towns of Paradise and Avon, (5) east of the town of Hyde Park, and (6) east and south from the city of Richmond. The association occupies about 6 percent of the survey area.

Nebeker and Hendricks soils are about equal in extent and together make up about 70 percent of this association, and Crowshaw, Hiibner, Hyrum, and Obray soils occupy the remaining 30 percent.

The Nebeker and Hendricks soils are well drained and have a surface layer of silt loam. The subsoil of the Nebeker soils is clay, and that of the Hendricks soils is silty clay loam.

The soils of this association are used mainly for nonirrigated crops of alfalfa and wheat, but some areas are used for range. The vegetation is mainly western wheatgrass, slender wheatgrass, prairie junegrass, balsamroot, yarrow, and big sagebrush.

9. *Richmond-Sterling-Picayune association*

Somewhat excessively drained soils that have gravelly loam or gravelly sandy loam underlying layers or a gravelly clay loam subsoil.

This association is in four areas: (1) the west slopes of Clarkston Mountains, (2) the west slope of the Wellsville Mountains, (3) the west-facing slopes of the mountains east of the cities of Richmond and Smithfield, and (4) the west-facing mountain slopes east of the towns of Paradise and Avon. The association occupies about 5 percent of the survey area.

Richmond soils occupy about 40 percent of this association, Sterling soils 25 percent, and Picayune soils about 15 percent. Outcrops of limestone rock and small areas of Nebeker soils make up the remaining 20 percent.

The Richmond soils are very steep and are on south- and west-facing mountains. They are somewhat excessively drained, and they are strongly calcareous to very strongly calcareous throughout the profile. The subsoil is very gravely, cobbly, and stony loam. The Sterling soils are very steep and are on south- and west-facing mountains. They are somewhat excessively drained and are strongly calcareous to very strongly calcareous throughout the profile. The Picayune soils generally are in the north-facing areas of the association, but they also are in small pockets in other exposures. They are well drained. The surface layer is very dark grayish brown, noncalcareous gravelly loam. The subsoil is gravelly and cobbly clay loam.

The soils of this association are used for range, wildlife habitat, and watershed. The vegetation is chiefly big sagebrush, juniper, cheatgrass, bluebunch wheatgrass, western wheatgrass, Sandberg bluegrass, yarrow, balsamroot, and bitterbrush. Deer and other wildlife use the vegetation for grazing in winter and spring.

Well-drained and Somewhat Excessively Drained Soils of the Mountains

Soils of this group are dominantly well drained to somewhat excessively drained. The subsoil is very gravelly. These soils formed in residuum, colluvium, and alluvium derived mainly from sandstone or quartzite and some limestone and shale rocks. They are sloping to very steep and are on mountains and alluvial fans at ranges of 5,300 to 8,000 feet. The average annual precipitation is 20 to 30 inches, the mean annual air temperature is 38° to 47° F., and the frost-free season is 50 to 100 days.

Two of the associations in the Cache Area are in this group. They make up about 16 percent of the survey area.

10. *Yeates Hollow-Ant Flat-Goring association*

Sloping to very steep soils that have a silty clay, clay, and very cobbly clay subsoil

This association consists of sloping to very steep soils on mountains. These soils are in five areas. The major ones of these are the upper Little Bear River area and the Hardware Ranch-Ant Flat area. The smaller ones are the Strawberry Valley area, the Franklin Basin area, and an area east of the town of Cove near the Idaho line. The association makes up about 12 percent of the survey area.

Yeates Hollow soils occupy about 35 percent of the association, Ant Flat soils about 20 percent, and Goring soils 15 percent. LaPlatta and Obray soils occupy the remaining 30 percent.

All the major soils of this association are well drained. The Yeates Hollow soils have a surface layer of extremely stony loam and a subsoil of very cobbly and stony clay. In the Ant Flat soils, the surface layer is loam and the subsoil is clay. The Goring soils have a silt loam surface layer and a silty clay subsoil.

The soils of this association are used for range that is grazed by sheep and cattle and for watershed and wildlife habitat. The vegetation is mainly bluebunch wheatgrass, tall native bluegrass, Great Basin wildrye, prairie junegrass, Columbia needlegrass, yarrow, geranium, balsamroot, lupine, buckwheat, yellowbrush, bitterbrush, and big sagebrush.

11. Sheep Creek-Hoskin-Curtis Creek association

Steep and very steep soils that have a gravelly and cobbly loam to clay loam subsoil

This soil association is in three, long, narrow areas. The largest of these is in the mountain area east of Ant Flat. A second area is on the east slope of Clarkston Mountain, and a third is west and south of the town of Wellesville. Small areas of the association are included in other associations in the mountains and high mountains. The soils generally are on south- or west-facing mountains. The association occupies about 4 percent of the survey area.

Sheep Creek soils occupy about 35 percent of this association, Hoskin soils about 20 percent, and Curtis Creek soils about 15 percent. Agassiz, St. Marys, Bradshaw, and Smarts soils and rock outcrop make up the remaining 30 percent.

Sheep Creek soils are well drained. The surface layer is cobbly loam, and the subsoil is very cobbly clay loam. Hoskin soils are well drained to somewhat excessively drained. The surface layer is cobbly loam or gravelly loam, and the subsoil is very cobbly loam. Curtis Creek soils are well drained. The surface layer is loam or cobbly loam, and the subsoil is loam and sandy clay loam.

The soils of this association are used as range for grazing by sheep and cattle and for watershed and wildlife habitat. The vegetation is mainly bluebunch wheatgrass, tall native bluegrass, Sandberg bluegrass, Great Basin wildrye, yarrow, balsamroot, big sagebrush, bitterbrush, and yellowbrush. Big sagebrush, bluebunch wheatgrass, cheatgrass, and weeds now make up a large part of the plant cover in many areas.

Well-drained and Somewhat Excessively Drained Soils of the High Mountains

Soils of this group are dominantly well drained and somewhat excessively drained. They have a gravelly, cobbly, and stony clay loam subsoil. The Agassiz, Dateman, Bickmore, and Bradshaw soils in this group formed mainly in residuum from limestone. The Lucky Star and Cluff soils formed largely in residuum from sandstone and quartzite rocks. These moderately steep to very steep soils are on mountains at elevations of 5,500 to 9,000 feet. The average annual precipitation is 20 to 35 inches, and the mean annual air temperature is 36 to 45° F.

Three of the associations in the Cache Area are in this group. They make up about 30 percent of the survey area.

12. Agassiz association

Very steep, stony and rocky soils that are silt loam and stony silty clay loam throughout

This association is in five general areas. The two larger of these are in the southeastern part of the county. They are the James Peak and Sharp Mountain area and the East Fork area of the Little Bear River drainage. The smaller areas are north of Monte Cristo Peak, in the Blacksmith Fork Canyon west of Hardware Ranch, and in the Franklin Basin-Beaver Mountain area. The association occupies about 5 percent of the survey area.

Agassiz soils occupy about 70 percent of the association, rock outcrop about 10 percent, and Foxol soils about 6 percent. The Foxol soils are important, particularly in the James Peak area. Bradshaw and Elwood soils make up the remaining 14 percent.

The Agassiz soils are somewhat excessively drained and are very cobbly silt loam and silty clay loam throughout. The Agassiz soils dominantly face to the south or west and are intermingled with outcrops of limestone on ridges and escarpments.

The soils are used mainly for range that is grazed by sheep. Other uses are wildlife habitat and watershed. The vegetation is mainly big sagebrush, curlleaf mountain-mahogany, bluebunch wheatgrass, buckwheat, snowberry, chokecherry, and some juniper.

13. Dateman-Agassiz-Bradshaw association

Steep and very steep soils that are cobbly or very cobbly silt loam and silty clay loam throughout or have a cobbly loam subsoil

This association is in the high mountains extending from the Blacksmith Fork River south to the vicinity of Sharp Mountain. The association occupies about 6 percent of the survey area.

Dateman and Agassiz soils each occupy about 35 percent of the association, and Bradshaw soils about 15 percent. Bickmore soils make up about 9 percent and rock outcrop about 6 percent of the remaining 15 percent.

The Dateman soils are well drained. They have a surface layer of very dark brown cobbly silt loam, and the subsoil is very cobbly silty clay loam. They have north-facing slopes, where the vegetation is conifers. The Agassiz soils are somewhat excessively drained. They are very cobbly silt loam and silty clay loam throughout. They are very steep in south- and west-facing areas in which there are outcrops and ledges of limestone. Bradshaw soils are well drained and have a cobbly loam subsoil. They are steep and very steep, and they are under a plant cover of grass and brush.

The soils of this association are used for range that is grazed mainly by sheep. Wildlife habitat and watershed are also important uses for these soils. The vegetation consists mainly of Douglas-fir and alpine fir on Dateman soils that have north-facing slopes, and bluebunch wheatgrass, Great Basin wildrye, ceanothus, serviceberry, big sagebrush, chokecherry, buckwheat, and balsamroot on other slopes. The trees are harvested for lumber in some areas of the Dateman soils.

14. Lucky Star-Cluff-Bickmore association

Moderately steep and steep soils that have a very cobbly sandy clay loam, gravelly clay, or cobbly silty clay loam subsoil

This association is in eight large areas: (1) the east-facing slopes of Clarkston Mountains, (2) the east-facing slopes of the Wellsville Mountains, (3) the mountain slopes west of the Upper Little Bear River, (4) the upper areas of Hyrum and Paradise Dry Canyons, (5) the areas south of Sharp Mountain to the Weber County Line, (6) the Monte Cristo area joining the Box Elder County Line, (7) the Upper Curtis Creek-Rock Creek area, and (8) the Franklin Basin-Beaver Mountain area. This is the largest association in the survey area and makes up about 19 percent of the total acreage.

Lucky Star soils occupy about 35 percent of the association, Cluff soils 25 percent, and Bickmore soils about 15 percent. Elwood, Fitzgerald, Scout, Elzinga, Maughan, and Scave soils make up the remaining 25 percent.

The Lucky Star soils are deep and well drained and have a very cobbly sandy clay loam subsoil. They have north- and east-facing slopes, where the vegetation is aspen. The Cluff soils are well drained and have a gravelly clay subsoil. The vegetation on these soils is conifers. The Bickmore soils are well drained and have a cobbly silty clay loam subsoil. They are very steep and have north- and east-facing slopes. The vegetation on Bickmore soils also is conifers.

Soils in this association are used mainly for watershed, wildlife habitat, and range. In some areas Douglas-fir is used for timber and the understory is grazed by sheep. In the aspen stands, Douglas-fir and alpine fir grow as scattered trees or are in small clumps. At present, markets for aspen products are limited in the survey area and the aspen sites are grazed by sheep and cattle.

Descriptions of the Soils

This section describes the soil series and mapping units in the Cache Area. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains a brief description of a representative profile that is in terms familiar to the layman. A detailed description of the same profile is given as part of the description of the first mapping unit. This second profile description is in technical terms and is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Mixed alluvial land, for example, does not belong to a soil series, but nevertheless, it is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, woodland group, and wildlife group in which the mapping unit has been placed. The page for the description of each of these groups can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*8*).

A given soil series in the Cache Area may be identified by a different name in a recently published soil survey of an adjacent survey area. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil series described in this Area are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained.

Agassiz Series

The Agassiz series consists of somewhat excessively drained, strongly sloping to very steep soils that formed in residuum derived from limestone. These soils occur mostly in mountainous areas at elevations of 5,500 to 8,500 feet. Their slopes face south and west and range from 6 to 70 percent. The annual precipitation is 20 to 35 inches, the mean annual air temperature is 36° to 42° F., and the frost-free season is 80 to 100 days. The vegetation is mainly big sagebrush, curlleaf mountain-mahogany, bluebunch wheatgrass, snowberry, serviceberry, chockecherry, and some juniper trees.

Agassiz soils are commonly associated with Goring, Mult, Elwood, Bradshaw, Dateman, Bickmore, and Lucky Star soils.

In a representative profile, the surface layer is about 18 inches thick and is brown very cobbly silt loam in the upper part and brown very cobbly silty clay loam in the lower part. It is neutral in reaction. Just below the surface layer is limestone bedrock. The upper 4 to 6 inches of the bedrock is fractured, and soil material has filled the cracks.

Agassiz soils are used for watershed, range, and wildlife habitat.

Agassiz rocky silt loam, 6 to 30 percent slopes (AAE).—This sloping to moderately steep soil is in mountainous areas and on ridges above lake terraces throughout the survey area. Rock outcrop covers 2 to 10 percent of the surface.

TABLE 1.—*Approximate acreage and proportionate extent of each mapping unit*

Mapping unit	Area	Extent
	Acres	*Percent*
Agassiz rocky silt loam, 6 to 30 percent slopes	2,855	0.5
Agassiz rocky silt loam, 30 to 70 percent slopes, eroded	2,040	.4
Agassiz-Bradshaw association, eroded	9,920	1.9
Agassiz-Dateman association, eroded	15,555	2.9
Agassiz-Elwood association, eroded	2,640	.5
Agassiz-Goring association	1,590	.3
Agassiz-Goring association, eroded	1,580	.3
Airport silt loam, 0 to 3 percent slopes	1,915	.4
Airport silty clay loam	1,540	.3
Airport-Salt Lake complex	2,175	.4
Ant Flat loam, 6 to 20 percent slopes	7,360	1.4
Ant Flat-Despain association, eroded	5,925	1.1
Avon silty clay loam, 0 to 3 percent slopes	3,440	.6
Avon silty clay loam, 3 to 6 percent slopes	2,000	.4
Avon silty clay loam, 6 to 10 percent slopes	1,035	.2
Avon silty clay loam, 10 to 20 percent slopes	625	.1
Avon-Collinston complex, 6 to 10 percent slopes	1,175	.2
Avon-Collinston complex, 10 to 30 percent slopes	1,160	.2
Barfuss-Leatham association	7,910	1.5
Battle Creek silty clay loam, 0 to 2 percent slopes	1,650	.3
Battle Creek silty clay loam, 8 to 15 percent slopes	565	.1
Bickmore gravelly silt loam, 30 to 70 percent slopes	330	(1)
Bickmore-Agassiz association, eroded	1,355	.3
Bickmore-Sheep Creek association, eroded	8,515	1.6
Blackrock extremely stony loam, 10 to 20 percent slopes	440	(1)
Blackrock gravelly loam, 3 to 6 percent slopes	235	(1)
Blackrock gravelly loam, 6 to 10 percent slopes	420	(1)
Blackrock gravelly loam, 10 to 20 percent slopes	495	(1)
Bradshaw-Agassiz association, eroded	5,185	1.0
Cache silty clay	1,560	.3
Cardon silty clay	2,222	.4
Center Creek silt loam	356	(1)
Clegg silt loam, 20 to 30 percent slopes	730	.2
Cluff silt loam, 6 to 30 percent slopes	1,190	.2
Cluff-Lucky Star association	2,120	.4
Cluff-Scout association	4,035	.8
Collett silty clay loam	5,890	1.1
Collinston loam, 1 to 6 percent slopes	815	.2
Collinston loam, 6 to 10 percent slopes	870	.2
Collinston loam, 10 to 30 percent slopes, eroded	1,335	.3
Collinston loamy fine sand, 0 to 3 percent slopes	433	(1)
Crookston loam, 0 to 3 percent slopes	3,355	.6
Crookston loam, 3 to 6 percent slopes	395	(1)
Crookston loam, 6 to 10 percent slopes	298	(1)
Crowshaw gravelly loam, 3 to 6 percent slopes	285	(1)
Crowshaw gravelly loam, 6 to 10 percent slopes	1,065	.2
Crowshaw gravelly loam, 10 to 20 percent slopes	700	.1
Curtis Creek-Goring association, hilly	2,300	.5
Curtis Creek-Goring association, steep	1,710	.3
Dagor silt loam, 4 to 8 percent slopes	305	(1)
Dagor silt loam, 10 to 20 percent slopes	455	(1)
Dateman-Bradshaw association	3,060	.6
Dateman extremely rocky silt loam, 40 to 80 percent slopes	7,545	1.5
Datwyler cobbly silty clay loam, 30 to 60 percent slopes	655	.1
Datwyler-Elzinga-Maughan association	6,450	1.3
Despain-Bickmore association	1,780	.3
Despain-Lucky Star association	840	.2
Elwood silt loam, 30 to 60 percent slopes	700	.1
Elwood-Agassiz association	1,115	.2
Elwood-Mult association, hilly	1,350	.3
Elwood-Mult association, steep	4,500	.9
Fitzgerald extremely stony loam, 10 to 20 percent slopes	3,040	.6
Flygare silt loam, 3 to 20 percent slopes	1,625	0.3
Foxol rocky loam, 30 to 60 percent slopes	5,050	1.0
Goring silt loam, 6 to 30 percent slopes	5,495	1.1
Goring-Obray association, eroded	8,440	1.6
Gravel pit	348	(1)
Green Canyon gravelly loam, 0 to 3 percent slopes	1,735	.3
Green Canyon gravelly loam, 3 to 7 percent slopes	440	(1)
Greenson loam, 0 to 3 percent slopes	13,070	2.5
Greenson loam, 3 to 6 percent slopes	695	.1
Greenson loam, 6 to 10 percent slopes	235	(1)
Greenson loam, deep over clay, 0 to 1 percent slopes	413	(1)
Greenson loam, deep over gravel, 0 to 1 percent slopes	244	(1)
Hendricks silt loam, 1 to 3 percent slopes	546	.1
Hendricks silt loam, 3 to 6 percent slopes	725	.1
Hendricks silt loam, 6 to 10 percent slopes	1,560	.3
Hendricks silt loam, 10 to 20 percent slopes	2,335	.5
Hiibner extremely stony clay loam, 1 to 30 percent slopes	1,480	.3
Hiibner gravelly clay loam, 3 to 10 percent slopes	212	(1)
Hiibner gravelly clay loam, 10 to 20 percent slopes	305	(1)
Hiibner gravelly clay loam, 20 to 30 percent slopes	205	(1)
Hillfield silt loam, 20 to 30 percent slopes, eroded	285	(1)
Hillfield-Timpanogos silt loams, 10 to 30 percent slopes, eroded	1,275	.3
Hoskin cobbly loam, 30 to 70 percent slopes, eroded	1,810	.4
Hoskin-Datwyler association, eroded	625	.1
Hoskin-Elzinga association, eroded	1,495	.3
Hoskin-Scave association	3,115	.6
Hoskin-Scout association, eroded	4,210	.8
Hoskin-Smarts association, eroded	910	.2
Hoskin gravelly loam, thick surface, 1 to 6 percent slopes	790	.1
Hyrum gravelly loam, 4 to 8 percent slopes	465	(1)
Hyrum gravelly loam, 10 to 25 percent slopes	620	.1
Hyrum cobbly loam, 4 to 8 percent slopes	430	(1)
Jordan silty clay loam	975	.2
Jordan-Lasil silty clay loams	1,303	.3
Kidman fine sandy loam, 0 to 2 percent slopes	3,200	.6
Kidman fine sandy loam, 8 to 15 percent slopes	225	(1)
Kidman fine sandy loam, deep water table, 0 to 2 percent slopes	8,310	1.6
Kidman fine sandy loam, deep water table, 2 to 4 percent slopes	290	(1)
Kidman fine sandy loam, deep water table, 4 to 8 percent slopes	545	.1
Kirkham-Shay complex	1,180	.2
Kirkham-Shay complex, strongly alkali	820	.2
Lakewin gravelly coarse sandy loam	472	(1)
LaPlatta silty clay loam, 30 to 50 percent slopes	292	(1)
LaPlatta-Obray association	4,457	.9
Layton loamy fine sand	1,920	.4
Leatham-Barfuss association, eroded	4,060	.8
Lewiston fine sandy loam	8,790	1.7
Lewiston fine sandy loam, strongly alkali	480	(1)
Logan silty clay loam	2,035	.4
Lucky Star silt loam, 6 to 30 percent slopes	5,900	1.1
Lucky Star gravelly silt loam, 30 to 60 percent slopes	14,930	2.9
Lucky Star-Goring association	4,460	.9
Lucky Star-Hoskin association	2,065	.4
Lucky Star-Red Spur complex, 6 to 30 percent slopes	1,185	.2

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of each mapping unit*—Continued

Mapping unit	Area	Extent
	Acres	*Percent*
Lucky Star-Scout association	2, 595	0. 5
Maughan-Datwyler association	800	. 1
McMurdie silt loam, 0 to 3 percent slopes	725	. 1
McMurdie silt loam, 3 to 6 percent slopes	1, 715	. 4
McMurdie silt loam, 6 to 10 percent slopes	1, 075	. 2
McMurdie-Hillfield silt loams, 10 to 30 percent slopes, eroded	460	(1)
Mendon silt loam, 0 to 3 percent slopes	9, 810	2. 0
Mendon silt loam, 3 to 6 percent slopes	5, 220	1. 0
Mendon silt loam, 6 to 10 percent slopes	2, 030	. 4
Mendon-Collinston complex, 1 to 6 percent slopes	1, 405	. 3
Mendon-Collinston complex, 6 to 30 percent slopes, eroded	4, 970	1. 0
Millville silt loam, 0 to 2 percent slopes	1, 750	. 3
Millville silt loam, 2 to 4 percent slopes	860	. 2
Mixed alluvial land	5, 465	1. 1
Mult-Agassiz association	3, 700	. 7
Mult-Agassiz association, eroded	1, 050	. 2
Mult-Lucky Star association	640	. 1
Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded	2, 830	. 5
Nebeker silt loam, 3 to 6 percent slopes	405	(1)
Nebeker silt loam, 6 to 10 percent slopes	840	. 2
Nebeker silt loam, 10 to 25 percent slopes	4, 600	. 9
Nibley silty clay loam, 0 to 3 percent slopes	7, 160	1. 4
Nibley silty clay loam, 3 to 6 percent slopes	965	. 2
Obray silty clay, 1 to 6 percent slopes	210	(1)
Parleys silt loam, 0 to 3 percent slopes	1, 600	. 3
Parleys silt loam, 3 to 6 percent slopes	890	. 2
Parleys silt loam, 6 to 10 percent slopes	515	(1)
Parlo silt loam, 0 to 3 percent slopes	2, 460	. 5
Parlo silt loam, 3 to 6 percent slopes	385	(1)
Parlo silt loam, 6 to 10 percent slopes	165	(1)
Payson silt loam	1, 190	. 2
Picayune-Agassiz association, eroded	3, 030	. 6
Picayune-Smarts association	905	. 2
Poleline-Agassiz association, eroded	1, 790	. 4
Preston fine sand, 0 to 10 percent slopes	325	(1)
Provo gravelly loam	750	. 1
Provo loam	1, 695	. 3
Quinney silt loam	2, 345	. 5
Richmond very stony loam, 30 to 70 percent slopes, eroded	2, 790	. 5
Richmond-Middle association, eroded	5, 550	1. 1
Richmond-Munk association, eroded	815	. 2
Richmond-Nebeker association, eroded	3, 970	. 8
Richmond-Sterling association, eroded	2, 415	. 5
Ricks gravelly loam, 0 to 3 percent slopes	5, 025	1. 0
Ricks gravelly loam, 3 to 6 percent slopes	1, 545	. 3
Ricks gravelly loam, 6 to 10 percent slopes	965	. 2
Riverwash	260	(1)
Rock land	15, 215	2. 9
Roshe Springs silt loam	2, 735	. 5
Rough broken land	3, 160	. 6
St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes	645	. 1
St. Marys-Curtis Creek association	2, 170	0. 4
Salt Lake silty clay	2, 185	. 4
Salt Lake silty clay loam	790	. 2
Salt Lake-Logan complex	345	(1)
Salt Lake-Roshe Springs complex	3, 085	. 6
Salt Lake-Trenton complex	520	. 1
Scave extremely rocky silt loam, 10 to 30 percent slopes	720	. 1
Scave silt loam, 10 to 30 percent slopes	2, 005	. 4
Scout gravelly loam, 40 to 70 percent slopes	1, 025	. 2
Shay silty clay loam	355	(1)
Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded	3, 820	. 7
Sheep Creek-Agassiz association, eroded	5, 270	1. 0
Sheep Creek-Despain association, eroded	2, 225	. 4
Sheep Creek-Maughan association, eroded	3, 115	. 6
Smarts silt loam, 10 to 30 percent slopes	1, 150	. 2
Smarts-Hoskin association, eroded	3, 950	. 8
Smarts-Lucky Star-Poleline association	6, 000	1. 2
Steed gravelly loam, 0 to 3 percent slopes	2, 620	. 5
Steed gravelly loam, 3 to 6 percent slopes	706	.
Steed gravelly loam, 6 to 10 percent slopes	890	.
Sterling gravelly loam, 6 to 10 percent slopes	595	. 1
Sterling gravelly loam, 10 to 20 percent slopes	2, 895	. 6
Sterling gravelly loam, 20 to 50 percent slopes, eroded	3, 170	. 6
Stony alluvial land	815	. 2
Timpanogos silt loam, 0 to 3 percent slopes	2, 000	. 4
Timpanogos silt loam, 3 to 6 percent slopes	910	. 2
Timpanogos silt loam, 6 to 10 percent slopes	845	. 2
Timpanogos silt loam, 10 to 20 percent slopes, eroded	360	(1)
Timpanogos silt loam, deep water table, 0 to 3 percent slopes	2, 015	. 4
Trenton silty clay loam, 0 to 2 percent slopes	13, 725	2. 6
Trenton silty clay loam, 2 to 4 percent slopes	260	(1)
Trenton silty clay loam, 4 to 8 percent slopes	430	(1)
Trenton silty clay loam, 8 to 20 percent slopes, eroded	745	. 1
Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes	3, 795	. 7
Wheelon silt loam, 10 to 30 percent slopes	1, 605	. 3
Wheelon silt loam, 30 to 50 percent slopes, eroded	3, 720	. 7
Wheelon-Collinston complex, 10 to 30 percent slopes, eroded	9, 400	1. 8
Winn silt loam	2, 290	. 4
Winn-Provo complex	1, 250	. 2
Woods Cross silty clay loam	205	(1)
Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded	8, 110	1. 6
Yeates Hollow extremely rocky silt loam, 6 to 30 percent slopes	5, 410	1. 0
Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes	4, 080	. 8
Total	520, 162	100. 0

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(1) Less than 0.1 percent.

Representative profile, located 1,200 feet north and 1,200 feet west of the SE. corner of sec. 19, T. 10 N., R. 3 E. (profile described between rock outcrops):

A11—0 to 7 inches, brown (7.5YR 5/3) very cobbly silt loam, dark brown (10YR 3/3) when moist; moderate, medium, granular structure; soft, very friable, nonsticky and slightly plastic; many fine and medium roots; neutral; clear, wavy boundary.

A12—7 to 18 inches, brown (7.5YR 5/3) very cobbly light silty clay loam, dark brown (7.5YR 3/3) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many, very fine, discontinuous, interstitial inped pores; neutral; abrupt, broken boundary.

R—18 inches, fractured limestone bedrock (about 90 percent rock); soil material in cracks.

The A horizon ranges from brown or dark brown to grayish brown in the upper part; its hue is 10YR or 7.5YR. Its texture ranges from very cobbly silt loam or extremely stony silt loam to cobbly light silty clay loam. In some places the profile contains a C horizon. The lower part of the A horizon and the C horizon range from brown and dark brown to reddish brown; hue is dominantly 10YR and 7.5YR, but it is 5 YR in places. Texture ranges from very cobbly or channery silty clay loam to very cobbly heavy loam. Coarse fragments, mainly cobblestones and gravel-size or channery fragments of limestone, make up 20 to 60 percent, by volume, of the upper part of the A horizon and 50 to 80 percent of the lower part of the A horizon and the C horizon. Stones cover as much as 10 percent of the surface in places. Depth to limestone bedrock is 10 to 20 inches. Reaction is neutral or mildly alkaline, and this soil is noncalcareous or slightly calcareous.

Permeability is moderate, and this soil holds 2 to 3.5 inches of available water above the bedrock. Some roots penetrate the fractured limestone to a depth of 2 feet or more. Runoff is medium to rapid, and the hazard of erosion is slight to moderate.

This soil is used for range, watershed, and wildlife habitat. (Capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Agassiz rocky silt loam, 30 to 70 percent slopes, eroded (AAG2).—This steep or very steep soil is in mountainous areas and on ridges above lake terraces throughout the survey area. Runoff is rapid or very rapid. This soil is moderately eroded, and the hazard of further erosion is high or very high.

This soil is used for range, wildlife habitat, and watershed. (Capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Agassiz-Bradshaw association, eroded (30 to 70 percent slopes) (ABG2).—This mapping unit consists of steep or very steep soils, mainly in the mountainous areas between Davenport Creek and Blacksmith Fork Canyon but also in the vicinity of Franklin Basin. About 75 percent of the acreage is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and 20 percent is Bradshaw silt loam, 30 to 60 percent slopes.

The Agassiz soil is on the sides of mountains. It has slightly convex slopes that face south and west, and it is moderately eroded. The cover of vegetation is mainly big sagebrush, bluebunch wheatgrass, snowberry, and curlleaf mountain-mahogany.

The Bradshaw soil occupies areas between spur ridges, and it is also on the sides of mountains. This soil has slightly concave slopes that face north and east. The vegetation is mainly serviceberry, snowberry, big sagebrush, ceanothus, and bluebunch wheatgrass.

Included in mapping were areas of Elwood silt loam, 30 to 60 percent slopes, that have a cover of conifers. This included soil makes up about 5 percent of the total acreage in the mapping unit.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. Bradshaw soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Neither soil is in a woodland suitability group; wildlife suitability group 3)

Agassiz-Dateman association, eroded (30 to 70 percent slopes) (ADG2).—Soils of this mapping unit are steep or very steep. They generally occur on Sharp Mountain in areas where spur ridges are common, and they also occupy areas that extend northward to Blacksmith Fork Canyon. About 55 percent of the mapping unit is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and 35 percent is Dateman cobbly silt loam, 40 to 70 percent slopes.

The Agassiz soil has slopes that face east and south. It is moderately eroded. The cover of vegetation is mainly sagebrush, scattered oak brush, maple, and perennial grasses.

The Dateman soil has slopes that face north. A representative profile for this soil is described under the Dateman series. The Dateman soil has a cover of Douglas-fir and alpine fir.

Included in mapping were areas of Bradshaw silt loam, 30 to 60 percent lopes, and of Mult silt loam, 30 to 50 percent slopes. Each of these included soils makes up about 5 percent of the total acreage in the mapping unit. They are in small basins or other concave areas. The Mult soil has a cover of aspen.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. Dateman soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Agassiz-Elwood association, eroded (30 to 70 percent slopes) (AEG2).—This mapping unit consists of steep or very steep soils in mountainous areas of the Logan River drainage areas near Franklin Basin. Elevations range from 7,000 to 8,200 feet, and the annual precipitation is 24 to 30 inches. About 55 percent of the mapping unit is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and 35 percent is Elwood silt loam, 30 to 60 percent slopes.

The Agassiz soil is moderately eroded, and it has slopes that face south and west. The vegetation is mainly big sagebrush, perennial grasses, and forbs.

The Elwood soil has slopes that face north and east. Vegetation on this soil is mainly Douglas-fir and lodgepole pine.

Included in mapping were areas of Fitzgerald extremely stony loam, 10 to 20 percent slopes, and of Mult silt loam, 30 to 50 percent slopes. Each of these included soils makes up about 5 percent of the total acreage in the mapping unit. The Fitzgerald soil is mainly toward the southern end of this predominantly limestone area, and it has slopes that face north. The Mult soil is in pockets and on the bottoms of draws and drainageways. It has a cover of aspen.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. Elwood soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Agassiz-Goring association (6 to 30 percent slopes) (AGE).—This mapping unit is north of Hardware Ranch in mountainous areas characterized by a network of ridges and drainageways. The elevation ranges from 6,500 to 7,500 feet, and the annual precipitation is 22 to 26 inches. About 70 percent of the mapping unit is Agassiz rocky silt loam, 6 to 30 percent slopes, and 30 percent is Goring silt loam, 6 to 30 percent slopes.

The Agassiz soil is on mountain ridges and has slopes that face south and west. It contains slightly more rock outcrop than Agassiz rocky silt loam, 6 to 30 percent slopes. The cover of vegetation is mainly mountain-mahogany and other shrubs, grasses, and forbs.

The Goring soil has concave slopes and is in draws and drainageways. It has a cover of grasses and sagebrush on all aspects.

These soils are used for range, watershed, and wildlife habitat. (The Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. The Goring soil is in capability unit VIe–M, nonirrigated; Mountain Loam range site. Neither soil is in a woodland suitability group; wildlife suitability group 3)

Agassiz-Goring association, eroded (30 to 70 percent slopes) (AGG2).—This mapping unit is in mountainous areas characterized by alternate concave-convex slopes, mainly north of Porcupine Reservoir. The annual precipitation is 20 to 25 inches, and the elevation ranges from 5,500 to 6,500 feet. About 55 percent of the mapping unit is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and about 35 percent is Goring silt loam, 30 to 60 percent slopes.

The Agassiz soil has convex, south- and west-facing slopes and is on ridges and side slopes. It is moderately eroded and has common fragments of limestone the size of stones scattered on the surface. The cover of vegetation is mainly big sagebrush, juniper, and perennial grasses and forbs.

The Goring soil has concave, dominantly east- and north-facing slopes and has a cover of big sagebrush, perennial grasses, and scattered maple trees.

Included in mapping unit were areas of Elzinga silt loam, 30 to 60 percent slopes, and Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded. Each of these included soils makes up about 5 percent of the total acreage of the mapping unit. The Elzinga soil is under dense stands of maple on east- and north-facing areas at the upper extremes of the elevation range for the mapping unit. The Steep Creek soil is under scattered shrubs and forbs at the lower elevation for the unit.

Soils of this mapping unit are used for rangeland, wildlife habitat, and watersheds. (The Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. The Goring soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Neither soil is in a woodland suitability group; wildlife suitability group 3)

Airport Series

The Airport series consists of somewhat poorly drained and poorly drained, saline and alkali soils. These soils formed in mixed lake sediment, derived mainly from limestone and quartzite. They are on low lake terraces at elevations of 4,420 to 4,460 feet. Slopes range from 0 to 3 percent. The vegetation is mainly saltgrass, foxtail, alkali sacaton, greasewood, and pickleweed. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Airport soils are associated with Payson, Logan, and Salt Lake soils.

In a representative profile (fig. 2), the surface layer is gray, mildly alkaline silt loam about 4 inches thick. The subsoil, about 12 inches thick, is gray, moderately alkaline silty clay loam in the upper part and light brownish-gray, very strongly alkaline silty clay loam in the lower part. The substratum is light-gray silty clay loam in the upper part and light-gray silt loam in the lower part. It extends to a depth of 60 inches or more and is very strongly alkaline. Lime has accumulated in the lower part of the subsoil and in the substratum.

Airport soils are used mostly for unimproved meadow pasture. Some areas have been drained and reclaimed and are used for irrigated crops. Principal crops are alfalfa, barley, sugar beets, and improved pasture.

Airport silt loam, 0 to 3 percent slopes (AhA).—This soil is on low lake terraces near the Cache Valley bottom. The areas extend from northwest of the city of Logan to the Idaho line.

Representative profile, about 400 feet south and 1,100 feet west of the northeast corner of sec. 6, T. 12 N., R. 1 E.:

A1—0 to 4 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, thin and medium, platy structure that parts to weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

B2t—4 to 11 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; very hard, firm, very sticky and very plastic; common fine roots; many fine pores; thin continuous clay films; moderately calcareous; moderately alkaline; clear, smooth boundary.

B3ca—11 to 16 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, medium, prismatic structure; very hard, firm, sticky and plastic; few fine roots; many fine pores; thin clay films in pores; strongly calcareous; very strongly alkaline; clear, smooth boundary.

C1ca—16 to 25 inches, light-gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) when moist; massive; extremely hard, firm, sticky and plastic; many fine pores; very strongly calcareous; very strongly alkaline; clear, smooth boundary.

C2—25 to 60 inches, light-gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) when moist; massive; hard, firm, sticky and plastic; many fine pores; common, medium, distinct, brownish-yellow (10 YR 6/6) mottles; very strongly calcareous; very strongly alkaline.

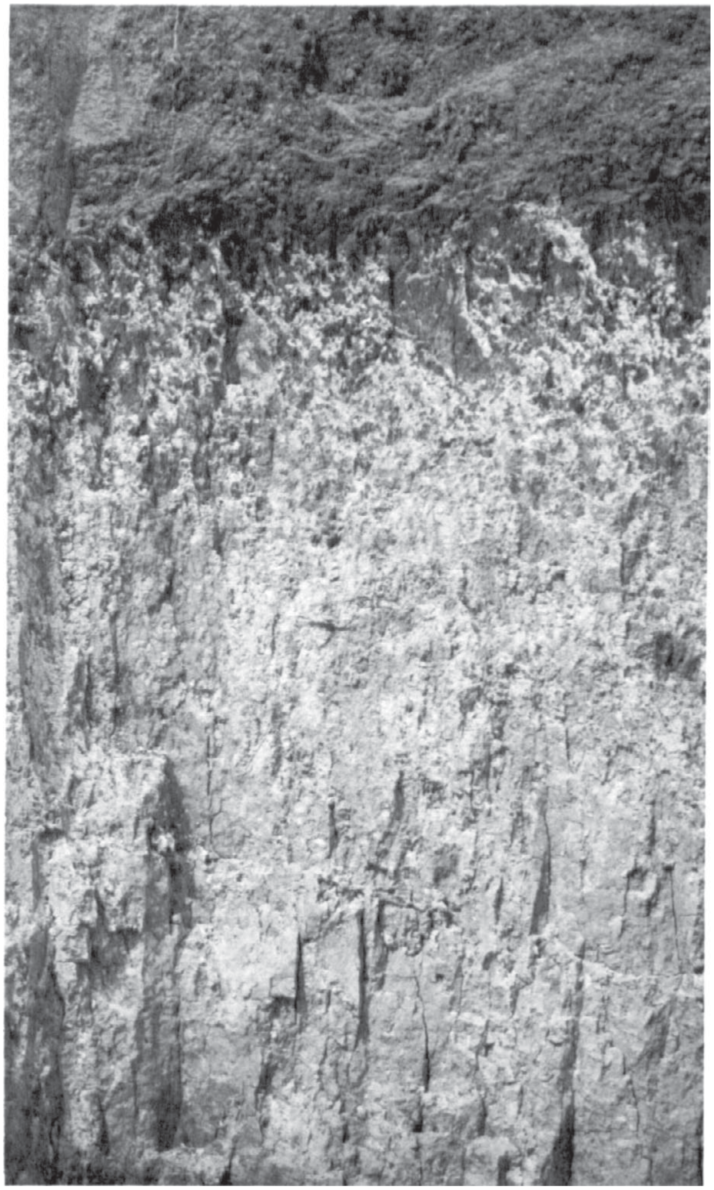

Figure 2.—**Profile of Airport silt loam, 0 to 3 percent slopes. This soil has a light-colored layer of lime accumulation just below the subsoil.**

The A1 horizon ranges from gray to dark gray to dark grayish brown in hues of 10YR and 2.5Y. It ranges from 4 to 11 inches in thickness. The B2t horizon ranges from gray to grayish brown or light brownish gray in hues of 10YR and 2.5Y. Structure most commonly is moderate to strong prismatic. The subsoil and the substratum are very strongly calcareous and are moderately alkaline to very strongly alkaline. Depth to a distinct horizon of carbonate accumulation ranges from 10 to 16 inches. The horizon of carbonate accumulation most commonly occurs in the lower part of the B horizon and extends into the C horizon. The content of exchangeable sodium generally is less than 15 percent in the A1 horizon; it ranges from 16 to 30 percent in the B2t horizon and from 35 to 95 percent in the C horizon. The C horizon ranges from light gray to light grayish brown or pale brown in hues of 10YR, 2.5Y, and 5Y. Its texture ranges mainly from silt loam to silty clay, but there are strata of sandy loam in places. The water table most commonly occurs at a depth of 24 to 36 inches, but it ranges from the surface to a depth of 40 inches. Distinct, brownish-yellow mottles commonly occur between depths of 20 and 40 inches.

This soil is moderately difficult to till. It is somewhat poorly drained. Permeability is slow or very slow in the subsoil and in the substratum. If this soil is drained and reclaimed, it holds 7 to 9 inches of available water to a depth of 5 feet. Plants commonly are shallow rooted because of the high concentrations of salt and alkali in the subsoil and the substratum. Runoff is slow to ponded, and the hazard of erosion is slight.

Included in mapping were small areas of soils that have a silty clay loam surface layer; small areas, generally bare, where the surface layer is strongly affected by alkali; and small areas of a ponded soil. Also included were areas of soils that contain a cemented hardpan.

This soil is used mainly for improved pasture. Drainage and reclamation are needed for cultivated crops. Tile or open drains have been installed in about 40 percent of the acreage. These drained and partly reclaimed areas are used for alfalfa, barley, sugar beets, corn for silage, and improved pasture. Maintaining the level of the water table and the high concentration of salts below the depth reached by crop roots is necessary to sustain good production. (Capability unit IVw–28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Airport silty clay loam (Ak).—This soil occurs at a slightly lower elevation than Airport silt loam, 0 to 3 percent slopes. It has a similar profile, however, except that the surface layer is silty clay loam and the subsoil and the substratum range to heavy silty clay loam. In places the water table is at or near the surface most of the time.

Included in mapping in the vicinity of Logan-Cache Airport were small tracts of a Payson silt loam that occupies areas ½ foot to 2 feet above areas of this Airport soil. Also included were small areas of a soil that has a silt loam surface layer, small areas of a ponded soil, and small areas of a soil that is strongly affected by salt and alkali (slickspots).

About 25 percent of the acreage of this Airport soil is drained and is used for irrigated crops of alfalfa, barley, sugar beets, and corn for silage and for improved pasture. The remaining 75 percent is in native pasture. (Capability unit IVw–28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Airport-Salt Lake complex (Am).—This complex consists of undulating soils on low lake terraces, mainly west and northwest of the city of Logan. About 60 percent of the complex is an Airport silt loam that has a shallow water table, and 40 percent is Salt Lake silty clay. Slopes are generally less than 1 percent.

The Airport soil is in irregularly shaped areas ½ foot to 2 feet above areas of the Salt Lake soil. It has a water table at a depth of 10 to 20 inches most of the time. The Salt Lake soil is in long, narrow, interconnected depressions.

Included in mapping were small areas of soils where slopes are more than 1 percent. Also included were a few small areas of a ponded soil.

Most of the acreage is used as native pasture. A few areas are in improved pasture. (Capability unit IVw–28, irrigated. Airport soil is in Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1. Salt Lake soil is in Wet Meadow range site; not in a woodland suitability group or in a wildlife suitability group)

Ant Flat Series

The Ant Flat series consists of well-drained soils that formed in residuum and colluvium derived from reddish Wasatch sandstone and shale. These soils are gently rolling or strongly sloping to steep and are in mountainous areas. The elevation ranges from 5,600 to 7,500 feet. Slopes range from 6 to 30 percent. The vegetation is dominantly bluebunch wheatgrass, tall native bluegrass, Idaho fescue, bitterbrush, big sagebrush, and snowberry. The average annual precipitation ranges from 20 to 26 inches, and the mean annual air temperature is 38° to 40° F. The frost-free season is 80 to 100 days. The Ant Flat soils are most commonly associated with Goring, Yeates Hollow, Hoskins and Despain soils.

In a representative profile, the surface layer is brown to dark-brown, slightly acid loam about 7 inches thick. The upper part of the subsoil is dark reddish-gray, yellowish-red, and red, neutral clay loam about 25 inches thick. The lower part of the subsoil, to a depth of 60 inches or more, is reddish-yellow, neutral clay loam and is strongly calcareous. Carbonates have been leached from the surface layer and upper part of the subsoil and redeposited in the lower part of the subsoil.

Ant Flat soils are used almost entirely for range, watershed, and wildlife habitat. Some areas were formerly dry-farmed, but most of these are now seeded to grasses.

Ant Flat Loam, 6 to 20 percent slopes (AND).—This moderately sloping to moderately steep soil is on all aspects of mountains. It is mainly in the Ant Flat area south of Hardware Ranch.

Representative profile in a range area, 2½ miles south of Anderson Ranch headquarters, ⅜ mile west of the road, near the north quarter corner of sec. 10, T. 9 N., R. 3 E.:

A1—0 to 7 inches, brown to dark-brown (7.5YR 4/2) heavy loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine and medium roots and a few large roots; slightly acid; clear, wavy boundary.

B1—7 to 11 inches, dark reddish-gray (5YR 4/2) light clay loam, dark reddish brown (5YR 2/3) when moist; moderate, fine, subangular blocky structure; hard, firm, slightly sticky and plastic; many fine and medium roots and a few large roots; many, very fine, discontinuous, random, tubular inped pores; few thin clay films on peds, continuous in pores; thin continuous organic stains; slightly acid; clear, wavy boundary.

B21t—11 to 18 inches, yellowish-red (5YR 5/6) heavy clay loam, yellowish red (5YR 4/6) when moist; strong, medium, subangular blocky structure; extremely hard, very firm, sticky and very plastic; common fine and medium roots and a few large roots; many very fine and few fine, discontinuous, random, tubular inped pores; thin continuous clay films on peds and in pores; thin organic stains; 10 percent gravel; slightly calcareous, lime is nonindurated, laminar, and veined; neutral; clear, wavy boundary.

B22t—18 to 32 inches, red (2.5YR 5/6) clay, dark red (2.5YR 3/6) when moist; weak, coarse, prismatic structure that parts to strong, coarse, subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine and medium roots; few, very fine and fine, discontinuous, random, tubular inped pores; thin continuous clay films in pores and on peds; cracks up to one-fourth inch wide in some places; moderately calcareous; lime is nonindurated, laminar, and veined; neutral; abrupt, wavy boundary.

B3ca—32 to 60 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) when moist; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; many, fine, discontinuous, interstitial, exped pores; thin clay films on some ped faces and in some pores; strongly calcareous; lime is nonindurated, veined and flaky; neutral.

The thickness of the solum ranges from 24 to 48 inches. The depth to the layer of carbonate accumulation ranges from 18 to 36 inches. The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Texture is dominantly loam but is marginal to silt loam in places. Reaction is slightly acid to neutral. Thickness of the A1 horizon ranges from 7 to 16 inches. The B2t horizon ranges from yellowish red or red to strong brown or reddish brown in a hue of 7.5YR, 5YR or 2.5YR. Texture ranges, from clay to heavy clay loam. Structure is weak to moderate, medium to coarse, prismatic and subangular blocky. Clay films are common to continuous, thin to moderately thick in pores and on some ped faces. Reaction ranges from slightly acid to mildly alkaline. The lower part of the B2t horizon is slightly calcareous to moderately calcareous. The B3ca horizon ranges from brown to red in a hue of 7.5YR, 5YR, or 2.5YR. Texture ranges from clay loam to light clay. Reaction is neutral to moderately alkaline. The B3ca horizon is moderately calcareous to strongly calcareous. In places a strongly calcareous Cca horizon is present. It has about the same colors as the B3ca horizon, but its texture ranges from clay loam to sandy loam.

This soil is fairly easy to till. Permeability is slow in the subsoil and moderately slow in the substratum. From 10 to 12 inches of available water is held to a depth of 5 feet. Plant roots penetrate to a depth of 4 feet or more. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Obray silty clay, 6 to 20 percent slopes, and Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded.

This Ant Flat soil is used almost entirely for range. Some areas were formerly cultivated and used for dry-farming, but these are now mostly seeded to grasses. (Capability unit VIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Ant Flat-Despain association, eroded (6 to 30 percent slopes) (AOE2).—This association lies south of the Hardware Ranch near Ant Flat and extends southward to the Weber County line. About 55 percent of the mapping unit is Ant Flat clay loam, 6 to 30 percent slopes, eroded; 30 percent is Despain gravelly loam, 20 to 30 percent slopes; and about 15 percent is included soils.

The Ant Flat soil is strongly sloping to steep. It has a profile similar to the one described as representative for the series, but the surface layer is clay loam and the subsoil is clay and is at a depth of 5 to 11 inches. This soil is moderately eroded and is strongly calcareous at a depth of 7 to 28 inches. It is underlain by calcareous sandstone at a depth of 40 to 48 inches. The slopes are dominantly 6 to 20 percent, but they range up to 30 percent. Runoff is slow to medium, and the hazard of erosion is moderate. The vegetation is mainly low sagebrush, mulesear dock, Idaho fescue, bluebunch wheatgrass, and yellowbrush.

The Despain soil has a profile similar to the one described as representative for the Despain series, but bedrock is at a depth below 40 inches in some places. Runoff is medium, and the hazard of erosion is moderate. The vegetation is mainly big sagebrush, bluebunch wheatgrass, native bluegrass, serviceberry, and bitterbrush.

Included in mapping were areas of Goring clay loam, 3 to 30 percent slopes; Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded; and an unidentified black clay.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Ant Flat soil is in capability unit VIe–M5, nonirrigated; Mountain Clay range site. Despain soil is in capability unit VIe–M, nonirrigated; Mountain Loam range site. Neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

Avon Series

The Avon series consists of well-drained soils that formed in mixed lake sediment derived chiefly from light-colored tuffaceous sandstone and limestone of the Salt Lake Formation. These soils are on high terraces, mainly along the west side of Cache Valley but partly in a smaller area east of the city of Richmond. The elevation ranges from 4,600 to 5,100 feet. Slopes range from 0 to 20 percent. The vegetation is dominantly bluebunch wheatgrass, western wheatgrass, and big sagebrush. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 110 to 140 days. Avon soils are associated with Collinston, Crookston, Mendon, and Wheelon soils.

In a representative profile, the surface layer and the upper part of the subsoil are dark-gray, neutral silty clay loam. The combined thickness of the surface layer and the upper part of the subsoil is 12 inches. The lower part of the subsoil is dark-gray and dark grayish-brown, mildly alkaline silty clay about 15 inches thick. The substratum, to a depth of 60 inches or more, is light-gray, moderately alkaline silt loam or silty clay loam. Carbonates have been leached from the surface layer and the subsoil and redeposited in the substratum.

Avon soils are used mainly for dryfarmed crops, but some areas are irrigated.

Avon silty clay loam, 0 to 3 percent slopes (ArA).—This soil is on high lake terraces along the west side of Cache Valley.

Representative profile, located northeast of the city of Richmond, 800 feet west of the south quarter corner of sec. 13, T. 14 N., R. 1 E.:

A1—0 to 9 inches, very dark gray (10YR 3/1) light silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, sticky and slightly plastic; many fine and medium roots; common, fine and medium, discontinuous, random, interstitial pores; neutral; clear, wavy boundary.

B1—9 to 12 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; weak, medium prismatic structure that parts to moderate, fine, angular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; few thin clay films in pores; neutral; clear, wavy boundary.

B21t—12 to 18 inches, dark-gray (10YR 4/1) light silty clay, very dark gray (10YR 3/1) when moist; weak, medium, prismatic structure that parts to moderate medium angular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common, fine, discontinuous, random, interstitial pores; common thin clay films in pores and on some peds; noncalcareous; mildly alkaline; clear, smooth boundary.

B22t—18 to 27 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to strong, medium, angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common, fine, discontinuous, random, interstitial pores; many thin clay films on ped faces and in pores; noncalcareous; mildly alkaline; clear, smooth boundary.

Cca—27 to 34 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; very strongly calcareous; lime is nonindurated, massive, veined, and flaky; moderately alkaline; clear, smooth boundary.

C—34 to 60 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; strongly calcareous, lime is nonindurated and massive; moderately alkaline.

The combined thickness of the A1, B1, and B2t horizons ranges from 24 to 41 inches over the lime accumulation. In places the A1 horizon is slightly calcareous because this soil has received overwash of strongly calcareous, eroded material from higher areas. In places small amounts of gravel and cobblestones are scattered on the surface and throughout the profile. Color of the A1 horizon ranges from very dark gray to dark gray. Texture ranges from silty clay loam to silt loam, and reaction is slightly acid to mildly alkaline. Thickness ranges from 9 to 15 inches. The transitional B1 horizon is present in most areas but is lacking in some. The B2t horizon ranges from dark grayish brown or dark gray to light brownish gray or light olive brown in a hue of 10YR or 2.5Y. Texture ranges from silty clay or clay to heavy silty clay loam. Structure ranges from weak to strong, and reaction is slightly acid to mildly alkaline. Thickness ranges from 12 to 26 inches. The C horizon ranges from light gray to white or pale yellow in a hue of 10YR, 2.5Y, or 5Y. Texture ranges from silty clay loam to silt loam, and in places this horizon is 10 to 40 percent unweathered tuffaceous gravel and cobblestones below a depth of 40 inches. The calcium carbonate equivalent in the lime horizon ranges from 15 to 40 percent.

The surface layer is easy to work. Permeability is moderately slow. Runoff is slow, and the hazard of erosion is slight. This soil holds 10 to 12 inches of available water. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of a soil that has a silt loam surface layer, and areas of a soil that has slopes of 3 to 6 percent.

About 85 percent of the acreage of this Avon soil is used for dry farming, and the principal crops are wheat, alfalfa, and safflower. The remaining 15 percent is irrigated and is used for alfalfa and small grain. (Capability unit IIc–2, irrigated, and IIe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Avon silty clay loam, 3 to 6 percent slopes (ArB).—This soil is slightly undulating and is on high lake terraces, mainly along the west side of Cache Valley. It is associated with Avon silty clay loam, 0 to 3 percent slopes. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of a soil that has slopes of 1 to 3 percent and small areas of a soil that has slopes of 6 to 10 percent. Also included were small areas of Collinston loam, 1 to 6 percent slopes.

This Avon soil is used mostly for dryfarmed alfalfa and wheat. Some areas are used for irrigated small grain and alfalfa. (Capability unit IIe–2, irrigated, and IIe–M, nonirrigated; not in a range site or woodland suitability group; wildlife suitability group 3)

Avon silty clay loam, 6 to 10 percent slopes (ArC).—This soil is on high lake terraces and escarpments, mainly along the west side of Cache Valley. It is similar to Avon silty clay loam, 0 to 3 percent slopes, except that it has slopes of 6 to 10 percent and the surface layer is 8 to 12 inches thick. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were a few small areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of Mendon silt loam, 6 to 10 percent slopes. Also included were a few areas of Avon soils that have slopes of 10 to 20 percent or of 3 to 6 percent.

This soil is used for dryfarmed winter wheat and alfalfa. (Capability unit IIIe–2, irrigated, and IIIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Avon silty clay loam, 10 to 20 percent slopes (ArD).—This soil has slopes that mainly face north or east. It is on lake terrace escarpments, mostly along the west side of Cache Valley. This soil is similar to Avon silty clay loam, 0 to 3 percent slopes, except that it is moderately eroded and the surface layer is only 8 to 10 inches thick. Runoff is medium to rapid, and the erosion hazard is moderate to high.

Included in mapping were small areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of Avon silty clay loam, 6 to 10 percent slopes.

This soil is used mostly for dryfarmed alfalfa and small grain. Some small areas are used for range. (Capability unit IVe–2, irrigated, and IVe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Avon-Collinston complex, 6 to 10 percent slopes (AsC).—This complex consists of gently rolling soils on high lake terraces along the west side of Cache Valley. About 70 percent of the complex is Avon silty clay loam, and 30 percent is Collinston loam. Runoff is medium, and the hazard of erosion is moderate.

The Avon soil is similar to Avon silty clay loam, 0 to 3 percent slopes, except that the surface layer is 8 to 10 inches thick. It has more gentle slopes than the Collinston soil, and its slopes face north.

The Collinston soil is similar to Collinston loam, 6 to 10 percent slopes, which is described under the Collinston series. It occupies the more exposed areas on ridges, and it has convex slopes that face south.

Included in mapping were areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of Collinston loam, 10 to 30 percent slopes.

Soils of this mapping unit are used for dryfarmed crops and for interspersed areas of range. Wheat, alfalfa, and safflower are the principal crops. (Capability unit IIIe–2, irrigated, IIIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Avon-Collinston complex, 10 to 30 percent slopes (AsE).—This mapping unit consists of rolling to hilly soils on terrace escarpments along the west side of Cache Valley. About 60 percent of the complex is Avon silty clay loam, 10 to 20 percent slopes, and about 40 percent is Collinston loam, 10 to 30 percent slopes, eroded. The Avon soil is in the less sloping areas and has slopes that face north or east. The Collinston soil is on the more exposed, convex ridges and has slopes that face south or west.

The Avon soil is similar to Avon silty clay loam, 0 to 3 percent slopes, except that it is steeper and its surface layer is 7 to 8 inches thick.

The Collinston soil is similar to Collinston loam, 6 to 10 percent slopes, except that it is steeper and is moderately eroded. In places plowing has exposed the subsoil.

Included in mapping were areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of Collinston loam, 6 to 10 percent slopes.

Soils of this mapping unit are used for dryfarmed wheat and alfalfa and for interspersed areas of range. (Capability unit IVe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Barfuss Series

The Barfuss series consists of well-drained soils. These soils formed in residuum and colluvium derived from light-colored tuff, conglomerate tuffaceous sandstone, and limestone of the Salt Lake Formation. They contain a large amount of volcanic ash. These soils are on slightly concave foothills at elevations of 5,200 to 6,000 feet. Slopes range from 10 to 50 percent. The vegetation is dominantly bluebunch wheatgrass, Great Basin wildrye, native bluegrass, big sagebrush, bitterbrush, and serviceberry. The average annual precipitation ranges from 17 to 20 inches, and the mean annual air temperature is 42° to 45° F. The frost-free season is 80 to 110 days. Barfuss soils are associated with LaPlatta and Leatham soils.

In a representative profile, the surface layer is dark-gray, mildly alkaline silt loam about 10 inches thick. The subsoil is dark-gray and dark grayish-brown, moderately alkaline silty clay loam about 17 inches thick. The substratum, to a depth of 60 inches or more, is white, strongly alkaline silt loam.

Barfuss soils are used mainly for range, watershed, and wildlife habitat.

Barfuss-Leatham association (30 to 50 percent slopes) (BAF).—This mapping unit is mainly south and west of Avon and south of Clarkston, but a small area is on the north end of Wellsville Mountain. About 40 percent of the association is Barfuss silt loam, 30 to 50 percent slopes; 30 percent is Leatham silt loam, 30 to 50 percent slopes; 20 percent is LaPlatta silty clay loam, 30 to 50 percent slopes; and 10 percent is included soils.

The Barfuss soil has slopes that face north and east, and it is in mountainous areas. The vegetation is mainly western wheatgrass, big sagebrush, Sandberg bluegrass, yarrow, bluebunch wheatgrass, bitterbrush, and Great Basin wildrye.

The Leatham soil has slopes that face mainly south and west. It has a cover of cheatgrass, big sagebrush, bluebunch wheatgrass, bitterbrush, snakeweed, and yarrow.

The LaPlatta soil, like the Barfuss, has slopes that face north and east. It has a cover of bluebunch wheatgrass, big sagebrush, Great Basin wildrye, Sandberg bluegrass, and yarrow.

Representative profile of Barfuss silt loam, that has slopes of 30 to 50 percent, in an area of Barfuss-Leatham association, 1,200 feet south and 800 feet west of the northeast corner of sec. 8, T. 9 N., R. 1 E.:

A1—0 to 10 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few medium roots; moderately calcareous; mildly alkaline; clear, smooth boundary.

B21t—10 to 19 inches, dark-gray (10YR 4/1) light silty clay loam, black (10YR 2/1) when moist; moderate, medium, subangular blocky structure; hard, friable, sticky and plastic; many very fine, fine, and medium roots; common, very fine and fine, discontinuous, random, vesicular pores; common thin clay films in pores and on some ped faces; moderately calcareous; moderately alkaline; clear, smooth boundary.

B22t—19 to 27 inches, dark grayish-brown (2.5Y 4/2) silty clay loam, very dark grayish brown (2.5Y 3/2) when moist; weak, fine, prismatic structure breaking to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots and few medium roots; common, fine, discontinuous, random, vesicular pores; many thin clay films in pores and on ped surfaces; strongly calcareous, lime is nodular; moderately alkaline; gradual, smooth boundary.

Cca—27 to 60 inches, white (2.5Y 8/1) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; very strongly calcareous; strongly alkaline.

The combined thickness of the A1 and Bt horizons ranges from 20 to 30 inches. The A1 horizon ranges from dark gray to gray. Texture is dominantly silt loam but is light silty clay loam in places. Reaction ranges from neutral to moderately alkaline, and the horizon is slightly to moderately calcareous. In places the profile contains a transitional, very dark gray B1 horizon. The B2t horizon ranges from dark gray to pale brown or light olive brown. Texture is dominantly clay loam or silty clay loam. Reaction is moderately alkaline to strongly alkaline, and the horizon is moderately to strongly calcareous. The Cca horizon ranges from white to pale brown or light gray in a hue of 10YR or 2.5Y. Texture is silt loam or heavy loam. The horizon is strongly or very strongly calcareous.

Permeability is moderately slow, and this soil holds from 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more. Runoff is rapid, and the hazard of erosion is high.

Included in mapping were areas of Wheelon silt loam, 30 to 50 percent slopes, eroded, and of Obray silty clay, 6 to 20 percent slopes. The Wheelon soil is on ridges. It has convex slopes, and the Obray soil has concave slopes. Both soils have slopes that face south and west.

Soils of this mapping unit are used mainly for range, watershed, and wildlife habitat. (Barfuss soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3. Leatham soil is in capability unit VIIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Battle Creek Series

The Battle Creek series consists of well-drained soils. These soils formed in mixed lake sediment derived mainly from limestone, sandstone, and quartzite. They are on lake terraces at elevations of 4,475 to 4,600 feet. Slopes are 0 to 20 percent. The vegetation is dominantly western wheatgrass, bluebunch wheatgrass, and big sagebrush. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 130 to 140 days. Battle Creek soils are mostly commonly associated with Parleys, McMurdie, Collett, Trenton, and Greenson soils.

In a representative profile, the surface layer is grayish-brown, neutral silty clay loam about 6 inches thick. The upper part of the subsoil is grayish-brown to brown, neutral to mildly alkaline silty clay about 13 inches thick. The lower part of the subsoil and the substratum are pinkish-gray, mildly to moderately alkaline silty clay to a depth of 60 inches or more. Carbonates have been leached from the surface layer and upper part of the subsoil and redeposited in the lower part of the subsoil and the substratum.

Battle Creek soils are used for irrigated and dryfarmed crops.

Battle Creek silty clay loam, 0 to 2 percent slopes (BcA).—This soil is on intermediate lake terraces of ancient Lake Bonneville. It is in the northeastern part of Cache Valley.

Representative profile, in a cultivated area 1 mile north and 1½ miles east of the Lewiston sugar factory, 200 feet south and 300 feet west of the northeast corner of sec. 2, T. 14 N., R. 1 E.:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) heavy silty clay loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure mixed with weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few fine pores; neutral; abrupt, smooth boundary.

B1—6 to 10 inches, grayish-brown (10YR 5/2) silty clay, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular structure; hard, firm, sticky and plastic; few fine roots; few fine pores; neutral; clear, smooth boundary.

B21t—10 to 13 inches, grayish-brown (10YR 5/2) silty clay, dark brown (10YR 3/3) when moist; weak, medium, prismatic structure that parts to weak, fine, subangular blocky structure; very hard, firm, sticky and very plastic; few fine roots; common fine and few medium pores; common thin clay films; slightly calcareous; mildly alkaline; gradual, wavy boundary.

B22t—13 to 19 inches, brown (7.5YR 5/2) silty clay, dark brown (7.5YR 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many fine and few medium pores; common thin clay films; moderately calcareous; mildly alkaline; gradual, wavy boundary.

B3ca—19 to 37 inches, pinkish-gray (7.5YR 6/2) silty clay, dark brown (7.5YR 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky structure; very hard, firm, sticky and very plastic; few fine roots; many fine pores; few thin clay films; strongly calcareous; mildly alkaline; gradual, wavy boundary.

C1ca—37 to 43 inches, pinkish-gray (7.5YR 7/2) silty clay, brown (7.5YR 5/4) when moist; common, medium, faint, strong-brown (7.5YR 5/8) mottles; medium subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine roots; many fine and few medium pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—43 to 72 inches, pinkish-gray (7.5YR 7/2) silty clay, brown (7.5YR 5/4) when moist; few, medium, faint, yellowish-brown (10YR 5/8) mottles; laminated lake sediments; extremely hard, very firm, sticky and very plastic; few fine roots; common fine pores; strongly calcareous; moderately alkaline.

The combined thickness of the A1, B1, and B2t horizons ranges from 12 to 24 inches over the horizon of carbonate accumulation. The A horizon ranges from grayish brown to brown in hues of 10YR or 7.5YR. Texture is dominantly silty clay loam but ranges to light silty clay. Reaction is neutral to mildly alkaline. This horizon generally is noncalcareous but is slightly calcareous in places because of rodent activity. Thickness ranges from 6 to 10 inches. The B2t horizon ranges from 8 to 16 inches in thickness. The carbonate accumulation most commonly is in the lower part of the B horizon and extends into the C horizon. The C horizon ranges from pinkish gray to light brown. Faint mottles commonly are present below a depth of about 30 inches.

This soil is moderately difficult to work, and soil compaction results if the soil is tilled when wet. Permeability is slow. This soil holds from 9 to 10 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more but commonly are concentrated at a depth of 2 or 3 feet. Runoff is slow, and the hazard of erosion is none to slight.

Included in mapping were small areas of Parleys silt loam, 0 to 3 percent slopes.

Most of the acreage is cultivated. About 60 percent of this acreage is dryfarmed, and 40 percent is irrigated. Where irrigation water is available, the principal crops are alfalfa, small grain, corn for silage, sugar beets, and pasture. (Capability unit IIIs-25, irrigated, IIIs-U5, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Battle Creek silty clay loam, 8 to 15 percent slopes (BcD).—This strongly sloping soil is along drainageways on intermediate lake terraces north and east of Richmond. It is similar Battle Creek silty clay loam, 0 to 2 percent slopes, except that it has slopes of 8 to 15 percent, its surface layer is 6 to 8 inches thick, and in places plowing has exposed the subsoil. Runoff is medium, and the erosion hazard is moderate.

Included in mapping were areas of Trenton silty clay loam, 2 to 4 percent slopes, and small areas where slopes are 15 to 20 percent.

This soil is used mostly for dryfarmed alfalfa and small grain. (Capability unit IVe-2, irrigated, IVe-U5, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Bickmore Series

The Bickmore series consists of well-drained soils that have a cobbly silty clay loam subsoil. These soils formed in residuum and colluvium derived from limestone. Bedrock is at a depth between 28 and 40 inches. These soils are 20 to 50 percent cobblestones and gravel-size, angular, limestone rock fragments throughout the profile. They are on mountains at elevations of 6,000 to 8,000 feet, and they have slopes that face north and east and range from 30 to 70 percent. The vegetation is dominantly Douglas-fir and alpine fir and an understory of mountain myrtle, snowberry, chokecherry, ceanothus, and grasses. Average annual precipitation is 25 to 30 inches, mean annual air temperature is 38° to 42° F., and mean soil temperature in summer is less than 59°. The frost-free season is 80 to 100 days. Bickmore soils are most commonly associated with Sheep Creek, Agassiz, Mult, and Picayune soils.

In a representative profile the surface layer is dark-brown to brown, slightly acid gravelly silt loam about 16 inches thick. The upper part of the subsoil is brown or dark-brown, neutral cobbly silty clay loam about 8 inches thick. The lower part of the subsoil is pale-brown, strongly calcareous very cobbly silty clay loam. Carbonates have been leached from the surface layer and redeposited to form a layer of lime above the bedrock.

Bickmore soils are used dominantly for watershed and wildlife habitat, but some areas are grazed or used for woodland.

Bickmore gravelly silt loam, 30 to 70 percent slopes (BGG).—This soil is on mountains and has slopes that face north and east. It is mostly in the South Cottonwood Canyon area or on the Wellsville Mountains, but it is also in the mountain areas south of Avon.

Representative profile, located in South Cottonwood Canyon, 800 feet south of the northwest corner of sec. 30, T. 10 N., R. 3 E.:

O1—4 to 1½ inches, fir needles.

O2—1½ inches to 0, partly decomposed fir needles.

A11—0 to 2 inches, dark-brown (10YR 3/3) gravelly silt loam, very dark grayish brown (10YR 3/3) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; loose, very friable, nonsticky and slightly plastic; many fine and common fine and medium roots; 20 percent gravel; slightly acid; abrupt, wavy boundary.

A12—2 to 16 inches, dark-brown to brown (10YR 4/3) gravelly silt loam, dark brown (10YR 3/3) when moist; moderate, coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and common medium and large roots; 20 percent gravel; neutral; clear, broken boundary.

B2t—16 to 24 inches, dark-brown to brown (10YR 4/3) cobbly silty clay loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine and medium roots; common thin clay films on peds; 40 percent cobblestones; neutral; clear, irregular boundary.

B3ca—24 to 37 inches, pale-brown (10YR 6/3) very cobbly silty clay loam, brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; slightly hard, firm, sticky and plastic; many fine and medium roots; few thin clay films on peds; 50 percent cobblestones; strongly calcareous; neutral; abrupt, discontinuous boundary.

R—37 inches, fractured limestone bedrock, about 90 percent rock with material similar to that of the B3ca horizon in the cracks.

The O horizon ranges from 2 to 4 inches in thickness. The combined thickness of the A1 and B2t horizons ranges from 18 to 36 inches. The A1 horizon has a hue of 10YR or 7.5YR. Texture is dominantly gravelly silt loam but is gravelly loam in places. From 15 to 50 percent of this horizon is gravel and cobblestones. Reaction is slightly acid to neutral. Thickness ranges from 13 to 16 inches. The B2t horizon ranges from brown or dark brown to pale brown in a hue of 10YR or 7.5YR. Texture is dominantly cobbly light silty clay loam or cobbly clay loam and 20 to 50 percent of the horizon is cobblestones and gravel. Reaction is medium acid to neutral. The B3ca horizon has the same colors and texture as the B2t horizon, except that the content of cobblestones and gravel ranges from 50 to 80 percent, by volume. Reaction ranges from neutral to moderately alkaline, and the soil is moderately calcareous to strongly calcareous.

Included in mapping were areas of Agassiz rocky silt loam, 30 to 70 percent slopes, eroded. This included soil makes up about 10 percent of the total acreage.

Permeability is moderate. This soil holds 4 to 6 inches of available water above the bedrock. Some plant roots extend into the cracks in the bedrock. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

This soil is used entirely for watershed, woodland, range, and wildlife habitat. Some timber formerly was harvested; but now only a few trees are cut. (Capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Bickmore-Agassiz association, eroded (30 to 80 percent slopes) (BKG2).—This mapping unit consists of soils in somewhat dissected scarp areas on the west side of Clarkston Mountain. Elevation ranges from 5,500 to 7,500 feet. Average annual precipitation is 20 to 25 inches. About 40 percent of the association is Bickmore gravelly silt loam, 30 to 70 percent slopes; 30 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and 20 percent is Picayune cobbly loam, 50 to 80 percent slopes. The other 10 percent is rock outcrop and minor soils.

The Bickmore soil is on the north-facing mountains under Douglas-fir and alpine fir. The Agassiz soil is on the sharp ridgetops in association with rock ledges and rock outcrop. The cover is shrubs and grass.

These soils are used entirely for watershed, range, and wildlife habitat. The wooded areas of Bickmore soils are inaccessible and are not used for wood products. (Bickmore soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. The Picayune soil is in capability unit VIIe–M4, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Bickmore-Sheep Creek association, eroded (30 to 70 percent slopes) (BLG2).—This mapping unit is in the Little Bear River drainage area in the vicinity of Three-Mile Canyon and Public Grove Hollow. About 40 percent of it is Bickmore gravelly silt loam, 30 to 60 percent slopes; 30 percent is Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded; 20 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and about 10 percent is included soils.

The Bickmore soil is on north-facing mountain areas under a cover of Douglas-fir and alpine fir. The Sheep Creek soil is on the lower part of south-facing mountain areas under a cover of sagebrush, bluebunch wheatgrass, bitterbrush, cheatgrass, and tall bluegrass. The Agassiz soil is on the upper part of south-facing mountain areas and convex ridges under a cover of curlleaf mountain-mahogany, bluebunch wheatgrass, sagebrush, and Oregon grape.

Included in mapping were areas of a deep, well-drained, fine-textured soil and a deep, well-drained loam.

Soils of this mapping unit are used entirely for range, watershed, and wildlife habitat. The areas of Bickmore soils are nearly inaccessible, and few trees have been cut. (Bickmore soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4. Sheep Creek soil is in capability unit VIIe–M4 nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Blackrock Series

The Blackrock series consists of well-drained soils that have a gravelly loam subsoil. These soils formed in mixed alluvium and colluvium derived from light-colored tuff, tuffaceous sandstone, and limestone. They are on alluvial fans and rolling foothills. These foothill areas are known locally as Newton Hill, Bergeson Hill, and Blackrock and Round Mountains. Elevations range from 4,600 to 5,700 feet, and slopes are 3 to 70 percent. The vegetation is mainly big sagebrush, bitterbrush, bluebunch wheatgrass, Great Basin wildrye, and cheatgrass. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the average frost-free season is 120 to 140 days. Blackrock soils are most commonly associated with Munk, Collinston, Mendon, and Wheelon soils.

In a representative profile, the surface layer is dark-gray, neutral gravelly loam about 22 inches thick. Below this is a layer of grayish-brown, neutral gravelly heavy loam about 17 inches thick. Between depths of 39 and 60 inches is light-gray, mildly alkaline, strongly calcareous gravelly clay loam.

Blackrock soils are used mainly for range, but some areas are used for dryland crops of alfalfa and small grain.

Blackrock gravelly loam, 10 to 20 percent slopes (BmD).—This soil is on foot slopes of Newton Hill, Bergeson Hill, and Blackrock and Round Mountains. It is mainly associated with Munk gravelly loam, 30 to 70 percent slopes.

Representative profile, located 2½ miles southwest of Trenton, 200 feet south and 800 feet east of the northeast corner of the southeast quarter of sec. 9, T. 13 N., R. 1 W.:

A11—0 to 8 inches, dark-gray (10YR 4/1) gravelly loam, black (10YR 2/1) when moist; moderate, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine, medium, and large roots; common medium pores; about 30 percent gravel; neutral; clear, smooth boundary.

A12—8 to 22 inches, dark-gray (10YR 4/1) gravelly heavy loam, black (10YR 2/1) when moist; moderate, medium, granular structure; hard, firm, sticky and plastic; many fine and medium roots; common fine and medium pores; about 25 percent gravel; neutral; clear, smooth boundary.

AC—22 to 39 inches, grayish-brown (10YR 5/2) gravelly heavy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; hard, firm, sticky and plastic; few fine roots; many fine and medium pores; about 40 percent gravel; neutral; clear, wavy boundary.

Cca—39 to 60 inches, light-gray (10YR 7/2) gravelly clay loam, dark grayish brown (10YR 4/2) when moist; massive; hard, firm, sticky and plastic; few fine roots; few fine pores; about 20 percent gravel; strongly calcareous; mildly alkaline.

The A1 horizon ranges from dark gray to very dark gray. Texture is gravelly loam to stony loam. Reaction is neutral to mildly alkaline. Thickness ranges from 20 to 25 inches. The content of gravel in the A1 horizon is 15 to 35 percent. The Cca and C horizons range from light gray to very pale brown in hues of 10YR to 2.5Y. Texture is gravelly loam, gravelly clay loam, or very gravelly loam. The very gravelly loam is at a depth of more than 40 inches. The content of coarse fragments ranges from 10 to 35 percent. Reaction is mildly alkaline to neutral. This horizon is moderately to strongly calcareous. The depth to the horizon of carbonate accumulation ranges from 23 to 46 inches.

This soil is fairly easy to till. Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds about 7.5 to 9 inches of available water to a depth of 5 feet. Plant roots extend to a depth of 5 feet or more.

Included in mapping were small areas of Hyrum gravelly loam, 10 to 25 percent slopes, and small areas of limestone rock outcrop.

This soil is used mostly for dryfarmed crops of small grain and alfalfa. Some areas are used for range. (Capability unit IVe–UX, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Blackrock gravelly loam, 3 to 6 percent slopes (BmB).—This soil is on alluvial fans. It is associated with Blackrock gravelly loam, 10 to 20 percent slopes, and is similar to that soil, except that the surface layer is 20 to 27 inches thick. Runoff is slow, and the hazard of erosion is slight.

Included in mapping were small areas of loamy, nongravelly soils and a few small cobbly and stony areas.

This soil is used mostly for dryfarmed crops of winter wheat and alfalfa. (Capability unit IIe–2, irrigated, IIIe–UX, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Blackrock gravelly loam, 6 to 10 percent slopes (BmC).—This soil is on alluvial fans. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas where slopes are 10 to 20 percent.

About 50 percent of the acreage is used for dryfarmed crops of alfalfa and winter wheat, and the rest is used for range. (Capability unit IIIe–2, irrigated, IIIe–UXE, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Blackrock extremely stony loam, 10 to 20 percent slopes (BnD).—This soil is on the high lake terrace escarpments in the vicinity of the town of Cove. It is similar to Blackrock gravelly loam, 10 to 20 percent slopes, except that from 15 to 25 percent of the surface layer and the subsoil is stones and as much as 70 percent of the lower part of the substratum is cobblestones and other stones. Also, the surface layer is 20 to 23 inches thick. The available water holding capacity is 6 to 7 inches. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of soil that has a clay loam texture, and small wet spots or seep areas. Also included were small areas of limestone rock outcrop.

This soil is used for range. It is too stony for cultivation. (Capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Bradshaw Series

The Bradshaw series consists of well-drained soils. These soils formed in colluvium derived from limestone. They are on north- and east-facing mountain areas or in slightly concave drainageways between ridges. The elevation ranges from 6,000 to 7,500 feet. Slopes range from 30 to 60 percent. The vegetation is dominantly Great Basin wildrye, bluebunch wheatgrass, serviceberry, big sagebrush, chokeberry, and snowberry. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature ranges from 38° to 42° F., and the frost-free season is 80 to 100 days. Bradshaw soils are commonly associated with Mult, Agassiz, Elwood, and Dateman soils.

In a representative profile, the surface layer is dark-brown, neutral silt loam about 14 inches thick. The subsoil is yellowish-brown, neutral cobbly loam about 13 inches thick. The substratum is yellowish-brown, neutral very cobbly loam. Limestone bedrock is at depths below 40 inches in places.

Bradshaw soils are used entirely for range, watershed, and wildlife habitat.

Bradshaw-Agassiz association, eroded (30 to 70 percent slopes) (BSG2).—This mapping unit consists of soils mainly in mountainous areas between Davenport Creek and the lower part of Blacksmith Fork Canyon. About 55 percent of the association is Bradshaw silt loam, 30 to 60 percent slopes; 40 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and 5 percent is included soils.

The Bradshaw soil is steep and very steep and has slightly concave slopes that face north and east. It is between spur ridges in mountainous areas. The vegetation is mainly snowberry, ceanothus, big sagebrush, serviceberry, chokeberry, and bluebunch wheatgrass.

The Agassiz soil is very steep and has slightly convex slopes that face south and west. The vegetation is mainly big sagebrush, serviceberry, curlleaf mountain-mahogany, and bluebunch wheatgrass.

Representative profile of Bradshaw silt loam having slopes of 30 to 60 percent, in an area of the Bradshaw-Agassiz association, eroded, 200 feet north of the south quarter corner of sec. 8, T. 8 N., R. 2 E.:

A1—0 to 14 inches, dark-brown (10YR 3/3) silt loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine, medium, and large roots; 10 percent gravel; neutral; gradual, irregular boundary.

B2—14 to 27 inches, yellowish-brown (10YR 5/4) cobbly loam, dark yellowish brown (10YR 4/4) when moist; weak, very coarse, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; common fine, medium, and large roots; 40 percent cobblestones and gravel; neutral; clear, wavy boundary.

C—27 to 60 inches, yellowish-brown (10YR 5/4) very cobbly loam, dark yellowish brown (10YR 4/4) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; 50 percent gravel and cobblestones; neutral.

The A1 horizon ranges from dark brown to brown. This horizon is dominantly silt loam but in places is gravelly very fine sandy loam that is 10 to 20 percent gravel, by volume. Reaction is slightly acid to neutral. Thickness ranges from 10 to 19 inches. The B2 horizon ranges from yellowish brown to light brownish gray. It is cobbly loam ranging to gravelly loam that is 30 to 50 percent cobblestones and gravel. Reaction is neutral to moderately alkaline. Thickness ranges from 13 to 22 inches. The C horizon ranges from yellowish brown to brown or pale brown. This horizon ranges from very cobbly loam or very gravelly loam to very gravelly sandy loam that is 40 to 80 percent gravel and cobblestones. Reaction is neutral to moderately alkaline.

Permeability is moderate to moderately rapid. This soil holds 5 to 7 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

Included in mapping were areas of Lucky Star gravelly loam, 30 to 60 percent slopes, and of Bickmore gravelly silt loam, 30 to 70 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Bradshaw soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Cache Series

The Cache series consists of poorly drained, saline soils. These soils formed in fine-textured lake sediment on flat valley bottoms or on lake plains. They are mainly west of Amalga. Elevations are from 4,420 to 4,440 feet. Slopes are 0 to 1 percent. The vegetation is saltgrass and pickleweed. Large areas are bare. The average annual precipitation is 14 to 17 inches, the mean annual air temperature ranges from 45° to 48° F., and the frost-free season is 110 to 160 days. Cache soils are associated with Trenton and Jordan soils.

In a representative profile, the surface layer is light brownish-gray, mildly alkaline silty clay about 4 inches thick. The underlying layer is light-gray and very pale brown to white, mildly alkaline silty clay that extends to a depth of more than 60 inches. These soils are strongly calcareous and strongly affected by salt and alkali.

Cache soils are essentially wasteland, but they have some use for wildlife habitat.

Cache silty clay (Ca).—This soil is on salt-encrusted lake plains, mainly west of Amalga and north of Trenton. Slopes are 0 to 1 percent.

Representative profile, about ½ mile north and 2 miles west of Amalga Church, 800 feet east and 200 feet north of the southwest corner of the quarter of sec. 14, T., 13 N., R. 1 W.:

A1sa—0 to 4 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) when moist; weak, very fine, subangular blocky structure and weak, fine, granular structure; hard, firm, sticky and plastic; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

C1sa—4 to 25 inches, light-gray (10YR 7/2) silty clay, brown (10YR 5/2) when moist; common, medium, distinct, dark-brown (7.5YR 4/4) mottles; massive; extremely hard, very firm, very sticky and very plastic; strongly calcareous; mildly alkaline; distinct, smooth boundary.

C2sa—25 to 39 inches, very pale brown (10YR 7/3) silty clay, brown (10YR 5/3) when moist; common, medium, distinct, dark-brown (7.5YR 4/4) mottles; massive; extremely hard, very firm, very sticky and very plastic; strongly calcareous; mildly alkaline; abrupt, wavy boundary.

C3sa—39 to 72 inches, white (5Y 8/2 and 10YR 8/2) silty clay, light olive gray (5Y 6/2) and light brownish gray (10YR 6/2) when moist; common, medium, distinct, yellowish-red (5YR 4/8) mottles; massive; extremely hard, very firm, very sticky and very plastic; strongly calcareous; mildly alkaline.

The A1 horizon ranges from light grayish brown to pale olive in a hue of 10YR, 2.5Y, or 5Y. Reaction is mildly to strongly alkaline. Thickness ranges from 3 to 5 inches. Texture is silty clay to heavy silty clay loam. The C horizon dominantly is white to light gray or very pale brown and ranges in a hue of 10YR, 2.5Y, or 5Y. Texture is silty clay to clay. Common to many, medium and coarse, distinct mottles ranging in color from 7.5YR 4/4 to 5Y 4/8 are below the surface soil. Reaction is mildly alkaline to strongly alkaline.

A salt crust commonly is on the surface, and the content of salt is more than 2 percent throughout the profile. Permeability is very slow. Runoff is very slow to ponded, saturated with water, but little of the water is available for plant growth because of the high content of salt. The water table generally is at or near the surface, and some areas are ponded for long periods.

Included in mapping were small areas of Airport silty clay loam.

In most places this soil is bare and is not suitable for cropping. It has limited use for wildlife habitat. (Capability unit VIIIw–28, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 1)

Cardon Series

The Cardon series consists of somewhat poorly drained soils that formed in mixed lake sediment derived from limestone and shale. These soils are on low lake terraces in the Youngward area southwest of the city of Logan. The elevation ranges from 4,420 to 4,470 feet. Slopes range from 0 to 3 percent. In uncultivated areas, mound microrelief is evident. The vegetation is foxtail, Kentucky bluegrass, saltgrass, and gumweed. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 46° to 48° F., and the frost-free season is 120 to 130 days. Cardon soils are most commonly associated with Greenson, Salt Lake, Collett, Nibley, and Logan soils.

In a representative profile, the surface layer is dark-gray, mildly alkaline silty clay about 11 inches thick. Below this is 51 inches of light-gray silty clay. The substratum is light-gray, extremely hard, massive silty clay that contains yellowish-brown or brown mottles. In summer, cracks from 1 to 2 inches wide open in the surface layer and in the material below it and remain open for more than 90 days unless the soil is irrigated. Deep cracking, to depths of 40 to 55 inches, and sloughing of soil material from the surface layer into the cracks have caused a mixing of colors below a depth of 10 to 15 inches (fig. 3). The soil generally is saturated within a depth of 30 inches if it is not drained, but it dries out to depths of 40 to 60 inches late in summer.

Cardon soils are used for irrigated crops and unimproved pasture.

Cardon silty clay (Cd).—This soil is on the broad, smooth, low lake terraces. Slopes are 0 to 3 percent.

Representative profile in a cultivated area, 1½ miles north of College Ward Church, 400 feet south and 200 feet east of the northwest corner of the northeast quarter of sec. 18, T. 11 N., R. 1 E.:

Ap—0 to 7 inches, dark-gray (2.5Y 4/1) silty clay, very dark gray (2.5Y 3/1) when moist; moderate, medium, subangular blocky structure that parts to weak, fine, granular structure; extremely hard, firm, sticky and plastic; common medium and large roots; few fine pores; moderately calcareous; mildly alkaline; clear, smooth boundary.

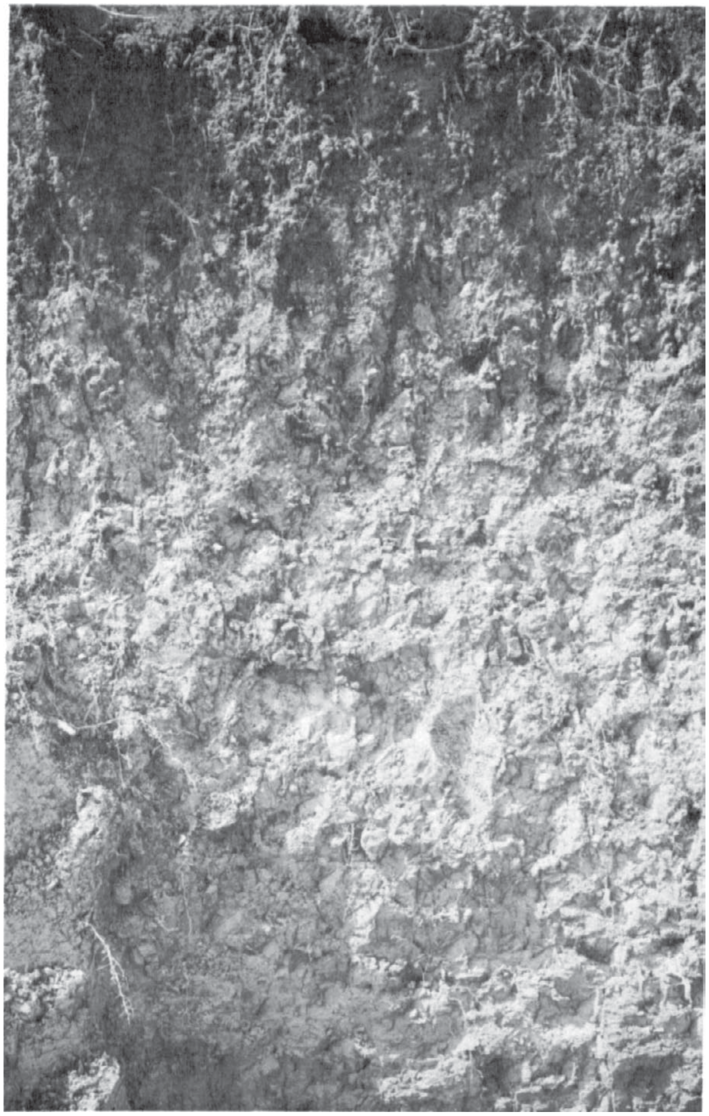

Figure 3.—**Profile of Cardon silty clay. Deep cracks form when this soil is dry. Dark-colored veins can be seen in the light-colored underlying material, where material from the surface layer has washed into the cracks.**

A12—7 to 11 inches, dark-gray (2.5Y 4/1) silty clay, very dark gray (2.5Y 3/1) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; extremely hard, extremely firm, sticky and plastic; many fine roots and few medium roots; common fine pores; moderately calcareous; mildly alkaline; clear, irregular boundary.

AC—11 to 34 inches, light-gray (2.5Y 7/2) and dark-gray (2.5Y 4/1) silty clay, light brownish gray (2.5Y 6/2) and very dark gray (2.5Y 3/1) when moist; irregular shaped peds with long axis not parallel to the surface; common slickensides; extremely hard, extremely firm, sticky and plastic; common fine roots and few medium roots; many fine pores; strongly calcareous; mildly alkaline; clear, irregular boundary.

C1—34 to 62 inches, light-gray (2.5Y 7/2) silty clay, light brownish gray (2.5Y 6/2) when moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; extremely hard, extremely firm, sticky and plastic; few medium roots; common fine pores; strongly calcareous; moderately alkaline.

The A horizon ranges from very dark gray to gray in a hue of 10YR or 2.5Y. Texture ranges from silty clay to heavy silty clay loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous. Its thickness ranges from 7 to 12 inches. The AC horizon is mixed, consisting of about 50 percent material that is A1 horizon and 50 percent C horizon. The upper part is dominated by the A1 horizon, and the lower part by the C horizon. The parallelepiped structure is weak to moderate, and slickensides are common to many. The C horizon ranges from light gray to light grayish brown in a hue of 10YR or 2.5Y. Texture ranges from silty clay to clay or heavy silty clay loam. Reaction ranges from moderately alkaline to strongly alkaline, and the horizon is strongly calcareous. Common, medium, distinct, yellowish-brown mottles occur at depths between 20 and 40 inches.

This soil is sticky and difficult to till. Permeability is very slow. This soil holds from 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate to depths of 5 feet or more. Runoff is slow, and the hazard of erosion is none to slight.

Included in mapping were a few small areas of Salt Lake soils.

This soil is used for irrigated crops and native pasture. The principal crops are alfalfa, small grains, and improved pasture plants. Some sugar beets and corn and silage is grown. (Capability unit IIIw–25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Center Creek Series

The Center Creek series consists of somewhat poorly drained soils that formed in mixed alluvium derived mainly from limestone rocks. These soils are on dry lake bottoms or fans at elevations of 5,600 to 5,700 feet. Slopes range from 1 to 3 percent. The vegetation is mainly water-tolerant grasses and sedges. Average annual air temperature is 42° to 44° F., and the frost-free season 75 to 90 days. Center Creek soils are associated with the soils of the Clegg and Hendricks series.

In a representative profile, the surface layer is dark grayish-brown, medium acid silt loam about 8 inches thick. The subsoil is dark grayish-brown and pale-brown, slightly acid silty clay loam 34 inches thick. The substratum, to a depth of 60 inches or more, is pale-brown, neutral silty clay loam and light yellowish-brown very fine sandy loam.

Center Creek soils are used for dryfarming, hay, and pasture. Alfalfa and small grain are the principal crops.

Center Creek silt loam (CE).—This soil is on valley bottoms in the Dry Lake area. Slopes are 1 to 3 percent.

Representative profile, approximately 800 feet west of the east quarter corner of sec. 32, T. 10 N., R. 1 W.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; hard, friable, slightly sticky and plastic; common fine roots and few medium and large roots; common, very fine, discontinuous, interstitial pores; medium acid; abrupt, smooth boundary.

B1—8 to 15 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; common fine roots and few medium and large roots; many, very fine, continuous, horizontal, inped tubular pores; few thin clay films in pores; slightly acid; gradual, smooth boundary.

B21t—15 to 26 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; strong, coarse, prismatic structure; very hard, very firm, sticky and plastic; common fine roots and few medium roots; many, very fine, continuous, vertical, inped tubular pores; common, moderately thick clay films in pores; slightly acid; gradual, wavy boundary.

B22t—26 to 34 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; common, coarse, distinct, strong-brown (7.5YR 5/8) mottles; moderate, coarse, prismatic structure; hard, firm, slightly sticky and plastic; many very fine tubular pores and few, fine, continuous tubular pores; common fine roots and few medium roots; few thin clay films in pores; thin organic staining on ped surfaces; slightly acid; gradual, wavy boundary.

B23t—34 to 42 inches, pale-brown (10YR 6/3) light silty clay loam, brown to dark brown (10YR 4/3) when moist; common, fine, distinct, strong-brown (7.5YR 5/8) mottles; weak, coarse, prismatic structure; hard, firm, slightly sticky and plastic; common very fine roots and few fine and medium roots; few thin clay films in pores; thin organic staining on ped surfaces; slightly acid; gradual, wavy boundary.

C1—42 to 52 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) when moist; few, fine, distinct, strong-brown (7.5YR 5/8) mottles; weak, coarse, prismatic structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; many very fine and few fine tubular pores; neutral; clear, smooth boundary.

C2—52 to 60 inches, light yellowish-brown (10YR 6/4) very fine sandy loam, dark yellowish brown (10YR 4/4) when moist; many, coarse, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; neutral.

The A horizon ranges from dark grayish brown to dark gray. Texture ranges from silt loam to light silty clay loam. Reaction is medium acid to neutral. Thickness ranges from 6 to 9 inches. The B1 horizon is only 4 to 8 inches thick and ranges from dark grayish brown to dark gray. The B2t horizon has common, coarse to fine, distinct mottles at depths below 26 inches. Its texture ranges from silty clay loam to fine sandy loam, and stratification is common.

This soil is fairly easy to till. Permeability is moderately slow. Runoff is slow to very slow, and the hazard of erosion is slight. Some areas are inundated until early in summer during years of high runoff. This soil holds 11 to 13 inches of available water to a depth of 5 feet. The depth to the water table ranges from 28 to 40 inches during the growing season. Roots are mostly in the upper 30 inches, above the water table, but extend to a depth of 60 inches or more.

This soil is used mostly for alfalfa, small grain, and native pasture. Water management and controlling the water table are important management needs. (Capability unit IIIw-3, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Clegg Series

The Clegg series consists of well-drained soils that formed in alluvium derived chiefly from limestone. These soils are on alluvial fans at elevations of 5,600 to 6,000 feet. Slopes range from 20 to 30 percent. The vegetation is dominantly maple, chokecherry, and some aspen and an understory grasses and forbs. The average annual precipitation is 22 to 24 inches, the mean annual air temperature is 42° to 43° F., and the frost-free season is 80 to 100 days. Clegg soils are most commonly associated with Bickmore, Agassiz, Datwyler, and Sheep Creek soils.

In a representative profile, the surface layer is dark-brown, slightly acid silt loam about 6 inches thick. The subsoil is brown, slightly acid heavy loam about 14 inches thick. The substratum, to a depth of 60 inches or more, is pale-brown, mildly alkaline, strongly calcareous very cobbly very fine sandy loam. All carbonates have essentially been leached from the surface layer and the upper part of the subsoil. A distinct layer of carbonate accumulation is at a depth of about 25 inches.

Clegg soils are used for range, watershed, and wildlife habitat.

Clegg silt loam, 20 to 30 percent slopes (CFE).—This soil is on alluvial fans in the Dry Lake area.

Representative profile, 1,600 feet south and 200 feet east of the northwest corner of sec. 29, T. 10 N., R. 1 W.:

O1—1½ inches to 0, matted leaves and twigs.

A1—0 to 6 inches, dark-brown (7.5YR 3/2) silt loam, very dark brown (7.5YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots and few large roots; common fine interstitial pores and few medium, interstitial pores; 10 percent gravel; slightly acid; gradual, wavy boundary.

B2t—6 to 20 inches, brown (7.5YR 4/2) heavy loam, dark brown (7.5YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; many fine and medium roots and few large roots; common fine interstitial pores; few thin clay films in pores and on some ped faces; 10 percent gravel; slightly acid; gradual, wavy boundary.

IIC1—20 to 25 inches, pale-brown (10YR 6/3) very cobbly very fine sandy loam, olive brown (2.5Y 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; common fine pores; 60 to 70 percent cobblestones and gravel; neutral; clear, smooth boundary.

IIC2ca—25 to 60 inches, pale-brown (10YR 6/3) very cobbly very fine sandy loam, olive brown (2.5Y 4/3) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; 60 to 80 percent cobblestones and gravel; strongly calcareous; mildly alkaline.

The O1 horizon ranges from 1 to 2 inches in thickness. The A1 horizon ranges from dark brown to dark grayish brown in a hue of 10YR or 7.5YR. Texture ranges from silt loam to loam that contains 10 to 15 percent gravel in places. Thickness ranges from 6 to 20 inches. The B2t horizon ranges from brown to dark grayish brown in hues of 7.5YR and 10YR. This horizon ranges from heavy loam to heavy silt loam and is about 10 percent gravel. The C horizon ranges from pale brown to light yellowish brown or to light brownish gray in a hue of 10YR or 2.5Y. It ranges from very cobbly very fine sandy loam to very cobbly fine sandy loam and is about 60 to 80 percent cobblestones and gravel. Depth to a distinct horizon of carbonate accumulation ranges from about 20 to 30 inches.

Permeability is moderate. This soil holds about 6 to 8 inches of available water to a depth of 5 feet. Roots extend to a depth of 5 feet or more. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Hendricks silt loam, 10 to 20 percent slopes, and Elzinga silt loam, 6 to 30 percent slopes.

This Clegg soil is used for range, watershed, and wildlife habitat. (Capability unit VIe-MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3)

Cluff Series

The Cluff series consists of well-drained soils. These soils formed in residuum and colluvium derived from sandstone, shale, and quartzite. They are on mountains at elevations of 7,200 to 8,500 feet. Slopes range from 6 to 30 percent. The vegetation is Douglas-fir, alpine fir, and some aspen. Average annual precipitation is 25 to 35 inches and is mostly snow. The mean annual air temperature ranges for 36° to 42° F., and the mean soil temperature is less than 59°. Cluff soils are associated with Scout, Lucky Star, Agassiz, and Hoskin soils.

In a representative profile, the surface layer is dark-brown or brown, medium acid to slightly acid silt loam about 9 inches thick. The subsurface layer is light-brown, medium acid very gravelly loam about 15 inches thick. Below this is light reddish-brown very gravelly clay loam about 7 inches thick. The subsoil is reddish-yellow, strongly acid very gravelly clay to a depth of 60 inches or more.

Cluff soils are used mainly for watershed and wildlife habitat. Some areas are used for wood products and some range.

Cluff silt loam, 6 to 30 percent slopes (CGE).—This soil is on mountains east of Hardware Ranch in the Baxter Sawmill area.

Representative profile of Cluff silt loam, 6 to 30 percent slopes, 1,200 feet south and 200 feet west of the northeast corner of sec. 9, T. 10 N., R. 4 E.:

O1—2½ to 2 inches, fir needles.

O2—2 inches to 0, partly decomposed litter that is mostly fir needles.

A11—0 to 4 inches, dark-brown to brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and nonplastic; many fine, medium, and large roots; medium acid; clear, wavy boundary.

A12—4 to 9 inches, brown (7.5YR 5/3) silt loam, dark brown (7.5YR 3/3) when moist; weak, coarse, subangular blocky structure that parts to fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine, medium, and large roots; common, very fine, discontinuous, random and inped interstitial pores; thick, continuous, light-colored coatings; slightly acid; clear, wavy boundary.

A22—9 to 24 inches, light-brown (7.5YR 6/3) very gravelly loam, brown (7.5YR 4/3) when moist; weak, coarse, subangular blocky structure that parts to medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; common, fine and medium roots and few large roots; common, very fine, discontinuous, random and inped interstitial pores; 65 percent gravel; medium acid; diffuse, wavy boundary.

A2&B2t—24 to 31 inches, about 60 percent of this horizon is similar to the A22 horizon and the 40 percent B2t part is light reddish-brown (5YR 6/4) very gravelly clay loam, light reddish brown (5YR 6/4) when moist; moderate, coarse, fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots and few large roots; common, very fine, discontinuous, random inped and interstitial pores; common thin clay films in pores; thick, light-colored coatings on peds; 60 percent gravel; strongly acid; clear, wavy boundary.

B2t—31 to 62 inches; reddish-yellow (5YR 6/6) very gravelly light clay, yellowish red (5YR 4/6) when moist; moderate, coarse to fine, subangular blocky structure; very hard, very firm, sticky and very plastic; few fine, medium, and large roots; common, very fine, discontinuous. random inped, interstitial, and tubular pores; common moderately thick clay films; moderate, patchy, light-colored coatings; 50 percent gravel; strongly acid.

The thickness of the O horizon ranges from 2 to 4 inches. The combined thickness of the A1, A2, and B2t horizons ranges from 40 to 60 inches. Coarse fragments are mainly cobblestones and gravel-size angular rock fragments; their content ranges from 5 to 50 percent in the A1 horizon, from 20 to 60 percent in the A2 horizon, and from 50 to 90 percent in the B2t horizon. The A1 horizon has a hue of 10YR or 7.5YR. Texture is very fine sandy loam. Thickness ranges from 6 to 9 inches. The A2 horizon ranges from light brown to reddish yellow or pale brown in a hue of 10YR or 7.5YR. Texture ranges from very gravelly loam to gravelly very fine sandy loam. Reaction ranges from slightly acid to strongly acid. Thickness ranges from 6 to 18 inches. The B2t horizon ranges from reddish yellow to reddish brown or strong brown in hues of 7.5YR, 5YR, and 2.5YR. Texture ranges from very cobbly clay or very gravelly clay to very gravelly heavy clay loam. Reaction ranges from medium acid to strongly acid.

Permeability is moderate. This soil holds 5 to 7 inches of available water to a depth of 5 feet. Roots extend to a depth of 5 feet or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Lucky Star silt loam, 6 to 30 percent slopes, which is under aspen.

This Cluff soil is used mainly as woodland and for watershed and wildlife habitat. Some areas are grazed by sheep. (Capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4)

Cluff-Lucky Star association (6 to 30 percent slopes) (CHE).—This mapping unit consists of soils mainly at the head of Hyrum Dry Canyon. About 60 percent of the association is Cluff silt loam, 6 to 30 percent slopes; 25 percent is Lucky Star silt loam, 6 to 30 percent slopes; and about 15 percent is included soils.

The Cluff and Lucky Star soils are on all exposures on mountains. The slopes are dominantly 10 to 20 percent. The landscape is rough and broken. The rock formations are tilted, and there are long, narrow, limestone and sandstone ridges that are oriented in a generally north-south direction. The dominant vegetation is conifers and some aspen. The Cluff soil is mainly under conifers, and the Lucky Star soil is mainly under aspen.

Included in mapping were areas of Agassiz rocky silt loam, 6 to 30 percent slopes, and Obray silty clay, 6 to 20 percent slopes. The Agassiz soil makes up about 10 percent of the total acreage in the association, and the Obray soil about 5 percent.

Soils of this mapping unit are used as woodland, for watershed, for wildlife habitat, and for range. (Cluff soil is in capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4. Lucky Star soil is in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Cluff-Scout association (6 to 40 percent slopes) (CIE).—This mapping unit consists of soils east of Hardware Ranch in the vicinity of Baxters Mill. About 70 percent of the association is Cluff silt loam, 6 to 30 percent slopes; 20 percent is Scout gravelly loam, 10 to 40 percent slopes; and 10 percent is included soils.

The Cluff soil is on all exposures on broad mountains. The Scout soil is commonly on ridges and very steep sides of ridges. A representative profile for the Scout soil is described under the Scout series. Generally, both soils are under Douglas-fir and alpine fir.

Included in mapping were areas of Scare silt loam, 10 to 30 percent slopes, and of Lucky Star silt loam, 6 to 30 percent slopes. Also included were a few outcrops of limestone bedrock at the bottom of mountain sides near the edges of deep canyons.

Soils of this mapping unit are used mainly for watershed, for wildlife habitat, and as woodland, but some areas are grazed by sheep. The wood products are used extensively. (Capability unit VIe-HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4)

Collett Series

The Collett series consists of somewhat poorly drained soils that formed in mixed, calcareous, lake sediment derived principally from limestone, sandstone, and shale. These soils are on medium and low lake terraces at elevations of 4,450 to 4,700 feet. Slopes range from 0 to 3 percent. The vegetation is foxtail, Kentucky bluegrass, saltgrass, and some sedges and wiregrass. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 45° and 48° F. and the frost-free season is 120 to 140 days. Collett soils are most commonly associated with Greenson, Nibley, Logan, Salt Lake, and Cardon soils.

In a representative profile, the surface layer is gray, mildly alkaline silty clay loam about 12 inches thick. The subsoil is gray to light-gray, moderately alkaline heavy silty clay loam about 5 inches thick. The substratum, to a depth of 60 inches or more, is white, moderately alkaline, strongly calcareous heavy silty clay loam that contains a horizon of carbonate accumulation.

Collett soils are used for irrigated crops and for unimproved meadow and pasture.

Collett silty clay loam (0 to 3 percent slopes) (Ck).—This soil is on the broad, smooth or slightly undulating, low lake terraces throughout Cache Valley.

Representative profile, in a cultivated area 1½ miles south of the Logan-Cache Airport, 1,000 feet south and 1,000 feet east of the northwest corner of the southwest quarter of sec. 21, T. 12 N., R. 1 E.:

Ap—0 to 7 inches, gray (10YR 5/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, sticky and plastic; few fine roots; few fine pores; moderately calcareous; mildly alkaline; clear, smooth boundary.

A1—7 to 12 inches, gray (10YR 5/1) heavy silty clay loam, very dark gray (10YR 3/1) when moist; very weak, medium, prismatic structure that parts to moderate, fine, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; slightly calcareous; mildly alkaline; clear, smooth boundary.

B2—12 to 17 inches, gray to light-gray (10YR 6/1) heavy silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, prismatic structure that parts to moderate, fine, subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; few fine pores; moderately calcareous; moderately alkaline; clear, smooth boundary.

C1ca—17 to 24 inches, white (2.5Y 8/2) heavy silty clay loam, light brownish gray (10YR 6/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; few medium and fine pores; strongly calcareous; moderately alkaline; clear, smooth boundary.

C2ca—24 to 34 inches, white (2.5Y 8/2) heavy silty clay loam, pale brown (10YR 6/3) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few fine roots; few fine pores; very strongly calcareous; moderately alkaline; abrupt, smooth boundary.

C3—34 to 60 inches, white (10YR 8/2) heavy silty clay loam, pale brown (10YR 6/3) when moist; common, medium, distinct, olive (5Y 5/6) or yellowish-brown (10YR 5/8) mottles; moderate, thin, platy structure; laminated lake sediment; hard, friable, slightly sticky and plastic; few fine roots; strongly calcareous; moderately alkaline.

The A horizon ranges from gray to dark gray. Texture ranges from heavy silty clay loam to heavy silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is slightly to moderately calcareous. Thickness ranges from 7 to 12 inches. The B2 horizon has a hue of 10YR or 2.5Y. Texture ranges from heavy silty clay loam to light silty clay. Reaction is mildly alkaline to moderately alkaline, and the horizon is slightly calcareous to moderately calcareous. Calcium carbonate equivalent in the Cca horizon is 22 to 60 percent. The C horizon ranges from white to pale brown or light gray. Texture ranges from silt loam to silty clay. Few to common, medium, distinct, yellowish-brown to strong-brown mottles are at a depth of more than 24 inches. A horizon of lime accumulation is in the upper part of the substratum at a depth of 16 to 22 inches. In places it is weakly cemented.

This soil is slightly difficult to till. Permeability is slow. This soil holds from 10 to 12 inches of available water to a 5-foot depth. In undrained areas the water table is at a depth of 20 to 36 inches, but in drained areas it is at a depth of 40 to 60 inches. Roots are mainly above the water table, but in drained areas they extend to a depth of 48 inches or more. Runoff is slow, and the hazard of erosion is none to slight.

Included in mapping were small areas of Greenson loam, 0 to 3 percent slopes. Also included were small areas of soils slightly affected by salt and alkali and areas of poorly drained soils.

Much of this Collette soil is drained; both tile and open drain systems are used. Irrigated crops are alfalfa, small grain, sugar beets, pasture, and corn for silage. Areas that have not been drained are used for wet meadow and pasture. (Capability unit IIIw-25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Collinston Series

The Collinston series consists of well-drained soils that formed in mixed sediment derived from light-colored tuff, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are strongly undulating or rolling and are on high lake terraces and terrace escarpments at elevations of 4,600 to 5,300 feet. Slopes range from 1 to 30 percent. The vegetation is dominantly bluebunch wheatgrass, cheatgrass, prairie junegrass, slender wheatgrass, Great Basin wildrye, Sandberg bluegrass, balsamroot, and aster. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 110 to 160 days. Collinston soils are most commonly associated with Mendon, Wheelon, Crookston, Avon, and Blackrock soils.

In a representative profile, the surface layer is gray, mildly alkaline loam about 15 inches thick. The underlying layer, to a depth of 60 inches or more, is white to very pale-brown, mildly alkaline to moderately alkaline, strongly calcareous silt loam or clay loam.

Collinston soils are used for dryfarming or for range.

Collinston loam, 6 to 10 percent slopes (CmD).—This undulating soil is on lake terraces. It is most commonly along the west side of Cache Valley in close association with Wheelon and Mendon soils, but some areas are south of Hyrum and east of Richmond.

Representative profile, in a cultivated area 1 mile west of Petersboro railroad warehouse, about 1,100 feet south and 900 feet west of the north quarter corner of sec. 19, T. 12 N., R. 1W.:

A11—0 to 8 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and medium roots; many fine pores; moderately calcareous; mildly alkaline; abrupt, smooth boundary.

A12—8 to 15 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many medium and fine pores; moderately calcareous; mildly alkaline; abrupt, smooth boundary.

C1ca—15 to 25 inches, white (10YR 8/2) clay loam, light gray (10YR 7/2) when moist; weak, fine, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many fine roots; many fine pores and few medium pores; very strongly calcareous; mildly alkaline; diffuse, smooth boundary.

C2—25 to 35 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; common fine pores; strongly calcareous; moderately alkaline; abrupt, irregular boundary.

C3—35 to 60 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; few, medium, distinct, yellowish-red (5Y 4/8) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine pores; strongly calcareous; moderately alkaline.

The A1 horizon ranges from gray to dark gray in hues of 10YR and 2.5Y. Texture ranges from loam to silt loam or light silty clay loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. Thickness ranges from 7 to 15 inches. The C horizon ranges from white to light gray or light brownish gray. Texture ranges from clay loam to silty clay loam or silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is strongly calcareous to very strongly calcareous. Some lime has been leached from the A horizon and redeposited in the upper part of the C horizon. In some places, partially weathered shale and cobblestones are in the C horizon at depths below 40 inches. In some places there are distinct, yellowish-brown or yellowish-red mottles below a depth of 30 inches.

This soil is fairly easy to till. Permeability is moderate. This soil holds 8 to 10 inches of available water to a depth of 5 feet. Roots penetrate easily to depths of about 48 inches. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Wheelon silt loam, 10 to 30 percent slopes, eroded, and small areas of a soil that has a gravelly loam or cobbly loam surface layer.

This soil is used for dryland crops of small grain, alfalfa, and alfalfa-grass mixtures. (Capability unit IVe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Collinston loam, 1 to 6 percent slopes (CmC).—This soil is on medium lake terraces, mainly in the Clarkston-Petersboro area. It is similar to Collinston loam, 6 to 10 percent slopes, except that it has slopes of 1 to 6 percent and the surface layer is 8 to 18 inches thick. Runoff is slow to medium, and the hazard of erosion is slight.

Included with this soil in mapping were small areas of Mendon silt loam, 3 to 6 percent slopes, and small areas of a Collinston silt loam that has slopes of 6 to 10 percent.

This soil is used mostly for dryland crops of winter wheat, alfalfa, and alfalfa-grass mixtures. (Capability unit IIIe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Collinston loam, 10 to 30 percent slopes, eroded (CmE2).—This soil is on high lake terraces, mainly in the Clarkston-Petersboro area. It is closely associated with Collinston loam, 6 to 10 percent slopes, and is similar to that soil except that it is steeper and the surface layer is 7 to 8 inches thick. In places, partly weathered shale and cobblestones are at a depth below 40 inches. Runoff is rapid, and the hazard of further erosion is high. This soil is moderately eroded.

Included in mapping were areas of Wheelon silt loam, 10 to 30 percent slopes, eroded; small areas of Mendon silt loam, 6 to 10 percent slopes, eroded; and small areas of Mendon silt loam, 6 to 10 percent slopes.

About 60 percent of the acreage is used for dryland crops of winter wheat, alfalfa, and alfalfa-grass mixtures. The remaining 40 percent is used for range that is grazed after crops in adjacent areas have been harvested. (Capability unit VIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Collinston loamy fine sand, 0 to 3 percent slopes (ClA).—This soil is on medium lake terraces north of the Newton cemetery. Slopes are slightly undulating.

The texture of the profile ranges from loamy fine sand to fine sandy loam in places. The surface layer ranges from 6 to 20 inches in thickness.

Included in mapping were small areas of a soil that has slopes of slightly more than 3 percent, and a few small areas of Crookston loam, 0 to 3 percent slopes.

This Collinston soil is easy to work and can be cultivated within a wide range of moisture content. It is somewhat excessively drained and is rapidly permeable. Runoff is very slow. The hazard of erosion is only moderate, but soil blowing is a major hazard. This soil holds 5 to 6 inches of available water to a depth of 5 feet. Sand ridges along fence rows are common.

Most of the acreage is used for dryland crops of alfalfa and winter wheat. A small acreage is sprinkler irrigated; sugar beets, alfalfa, and some corn for silage are grown. (Capability unit IIIs–24, irrigated, IIIs–U4, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crookston Series

The Crookston series consists of well-drained soils that formed in mixed lake sediment derived dominantly from light-colored tuff, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are on medium and high lake terraces at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 10 percent. The vegetation is dominantly big sagebrush, bluebunch wheatgrass, western wheatgrass, and balsamroot. The average annual precipitation is 15 to 17 inches. The mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 150 days. Crookston soils are most commonly associated with Mendon, Avon, Collinston, and Wheelon soils.

In a representative profile, the surface layer is gray, mildly alkaline loam about 14 inches thick. The subsoil is grayish-brown, mildly alakline loam about 13 inches thick. The substratum, to a depth of 60 inches, is light-gray, strongly calcareous, mildly alkaline loam and fine sandy loam. Most carbonates have been leached from the surface layer and upper part of the subsoil and redeposited at depths of 20 to 28 inches to form a distinct lime horizon.

Crookston soils are used mainly for dryland crops of alfalfa and small grain. Where water is available, some areas are irrigated.

Crookston loam, 0 to 3 percent slopes (CoA).—This soil is on the medium lake terraces. It is generally on the west side of Cache Valley between the towns of Mendon and Clarkston.

Representative profile, in a cultivated field about 2 miles north and ½ mile west of Newton, 500 feet north and 40 feet east of the southwest corner of sec. 6, T. 13 N., R. 1 W.:

Ap—0 to 6 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure and weak, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; many fine roots; noncalcareous, mildly alkaline; abrupt, smooth boundary.

A1—6 to 14 inches, gray (10YR 5/1) loam, very dark gray (10 YR 3/1) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine roots; common fine pores; noncalcareous; mildly alkaline; clear, smooth boundary.

B2t—14 to 27 inches, grayish-brown (10YR 5/2) loam, very dark gray (10YR 3/1) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine and medium pores; common thin clay films; noncalcareous; mildly alkaline; clear, wavy boundary.

C1ca—27 to 48 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine and medium pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C2ca—48 to 60 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; many fine and medium pores; strongly calcareous; mildly alkaline.

The A horizon ranges from gray to dark gray. Its texture is loam, silt loam, or fine sandy loam. The horizon is as much as 5 percent gravel in places. Thickness ranges from 10 to 18 inches. The B2t horizon ranges from grayish brown to gray or dark gray. Texture ranges from loam to silt loam. The C and Cca horizons range from light gray to white or pale yellow in hues ranging from 10YR to 5Y. Texture ranges from clay loam to fine sandy loam. The Cca horizon has a calcium carbonate equivalent of 25 to 35 percent.

This soil is easy to till. Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 4 to 6 feet.

Included in mapping were small areas of Mendon silt loam, 0 to 3 percent slopes.

All the acreage of this Crookston soil is cultivated. About 75 percent of the acreage is used for dryland crops of alfalfa, winter wheat, and safflower. The remaining 25 percent is used for irrigated crops of alfalfa, small grain, pasture, sugar beets, and corn for silage. (Capability unit IIc-2, irrigated, IIIe-U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crookston loam, 3 to 6 percent slopes (CoB).—This slightly undulating soil is on lake terraces along the west side of Cache Valley, between the towns of Mendon and Clarkston. It is similar to Crookston loam, 0 to 3 percent slopes, except that it has slopes of 3 to 6 percent, its surface layer is only 7 to 12 inches thick, and its subsoil is only 6 to 12 inches thick. Runoff is slow to medium, and the hazard of erosion is slight.

Included in mapping were a few small areas of soil that has slopes of 6 to 10 percent, and small areas of Collinston loam, 1 to 6 percent slopes.

All the acreage of this Crookston soil is cultivated. About 75 percent of the acreage is used for dryland crops of alfalfa and winter wheat. The remaining 25 percent is used for irrigated crops of alfalfa and small grain. (Capability unit IIe-2, irrigated, IIIe-U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crookston loam, 6 to 10 percent slopes (CoC).—This soil is on high lake terraces. It is similar to Crookston loam, 0 to 3 percent slopes, except that it is steeper, its surface layer is only 7 to 10 inches thick, and its subsoil is only 4 to 12 inches thick. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were a few small areas of a soil that has slopes of 3 to 6 percent, and small areas of Collinston loam, 6 to 10 percent slopes.

This Crookston soil is used mostly for dryland crops of alfalfa and winter wheat, but a few small areas are irrigated. (Capability unit IIIe-2, irrigated, IIIe-UE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crowshaw Series

The Crowshaw series consists of well-drained soils that formed in alluvium derived mainly from sandstone. These soils are on old alluvial fans deposited on high lake terraces at elevations of 4,500 to 5,000 feet. Slopes range from 3 to 20 percent. The vegetation is blue bunch wheatgrass, western wheatgrass, big sagebrush, and balsamroot. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Crowshaw soils are most commonly associated with Hendricks, Dagor, and Timpanogos soils.

In a representative profile, the surface layer is very dark grayish brown, slightly acid gravelly loam about 16 inches thick. The subsoil is dark-brown to brown, slightly acid gravelly loam about 14 inches thick. The substratum is brown, slightly acid gravelly loam to a depth of 60 inches or more.

Crowshaw soils are used for dry cropland.

Crowshaw gravelly loam, 6 to 10 percent slopes (CrC).—This soil is on old alluvial fans extending from the town of Mendon south almost to Sardine Canyon.

Representative profile, 1½ miles south of Mendon, 1,400 feet south of the northwest corner of the northeast quarter of sec. 20, T. 11 N., R. 1 W.:

Ap—0 to 10 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine and medium pores; 15 percent gravel; slightly acid; clear, wavy boundary.

A1—10 to 16 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine roots; common fine and medium pores; 15 percent gravel; slightly acid; clear, wavy boundary.

B2—16 to 30 inches, dark-brown to brown (10YR 4/3) gravelly loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; common thin clay films in pores and on some peds; 15 percent gravel; slightly acid; clear, wavy boundary.

C—30 to 60 inches, brown (7.5YR 5/4) gravelly loam, dark brown to brown (7.5YR 4/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; 20 percent gravel; slightly acid.

The A horizon ranges from very dark grayish brown to dark grayish brown and is 10 to 20 percent gravel. Reaction is slightly acid to neutral. Thickness ranges from 8 to 16 inches. The B horizon ranges from dark brown to brown or to grayish brown in a hue of 7.5YR or 10YR. The horizon is gravelly loam to gravelly heavy loam and is 15 to 25 percent gravel. The C horizon ranges from brown to yellowish brown or to pale brown in a hue of 7.5YR or 10YR. It is gravelly loam or very gravelly loam that is 15 to 35 percent gravel. A few angular cobblestones of sandstone and other stones commonly are below a depth of 30 inches. In places there is strongly calcareous lake sediment below a depth of 40 inches.

This soil is fairly easy to till, but the gravel causes excessive wear on tillage implements. Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds 7 to 9 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of Hendricks silt loam, 6 to 10 percent slopes.

This Crowshaw soil is used mostly for dryland crops of alfalfa and small grain. Controlling erosion is the most important concern in management. (Capability unit IIIe-2, irrigated, IIIe-UXE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crowshaw gravelly loam, 3 to 6 percent slopes (CrB).—This soil is on the lower parts of old alluvial fans along the foothills of the Wellsville Mountains. It is similar to Crowshaw gravelly loam, 6 to 10 percent slopes, except that it has slopes of 3 to 6 percent and the surface layer is 12 to 19 inches thick. Runoff is slow to medium, and the hazard of erosion is slight.

Included in mapping were small areas of soil that is not gravelly, and a few small areas of Hendricks silt loam, 3 to 6 percent slopes. Also included were a few small areas of soil that has slopes of slightly less than 3 percent.

This Crowshaw soil is used for dryland crops of alfalfa and winter wheat. (Capability unit IIe-2, irrigated, IIIe-UX, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Crowshaw gravelly loam, 10 to 20 percent slopes (CrD).—This soil is on alluvial fans and is associated with Hendricks silt loams and other Crowshaw soils. It is similar to Crowshaw gravelly loam, 6 to 10 percent slopes, except that the surface layer is only 7 to 14 inches thick. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of soils that have an accumulation of cobblestones or stones on the surface. Also included are a few small areas where slopes are slightly more than 20 percent.

This soil is used mostly for dryland crops of alfalfa and winter wheat. A few small areas are used as range. (Capability unit IVe-UX, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Curtis Creek Series

The Curtis Creek series consists of well-drained soils that formed in residuum derived from sandstone. These soils are 13 to 20 inches deep over fractured bedrock. They are on mountains at elevations of 6,000 to 8,000 feet. Slopes range from 10 to 60 percent. The vegetation is dominantly bluebunch wheatgrass, Columbia needlegrass, slender wheatgrass, Great Basin wildrye, native bluegrass, big sagebrush, and yellowbrush. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 38° to 42° F., and the frost-free season is 80 to 100 days. Curtis Creek soils are most commonly associated with Hoskin, Goring, Lucky Star, and Ant Flat soils.

In a representative profile, the surface layer is brown to dark-brown, medium acid loam about 8 inches thick. The subsoil is reddish-brown to yellowish-red slightly acid to neutral heavy loam or light sandy clay loam about 10 inches thick over fractured sandstone bedrock.

Curtis Creek soils are used for range, watershed, and wildlife habitat.

Curtis Creek-Goring association, hilly (6 to 30 percent slopes) (CSE).—This mapping unit consists of soils on mountains that have spur ridges in the Curtis Creek-Mollens Hollow area east of Hardware Ranch. The general aspect is dominantly south, but some exposures face east and west. About 65 percent of the association is Curtis Creek loam, 10 to 30 percent slopes; 25 percent is Goring silt loam, 6 to 10 percent slopes; and about 10 percent is included soils.

The Curtis Creek soil is dominantly moderately steep and is on ridges. The Goring soil is moderately steep in concave areas and swales. The vegetation on both soils is shrubs and grass.

Representative profile of Curtis Creek loam, 6 to 30 percent slopes, in an area of Curtis Creek-Goring association, hilly, 1,300 feet north and 1,200 feet west of southeast corner of sec. 19, T. 10 N., R. 4 E.:

A1—0 to 8 inches, brown to dark-brown (7.5YR 4/3) loam, very dark brown (7.5YR 2/2) when moist; moderate, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; many fine and very fine roots and a few medium roots; medium acid; clear, smooth boundary.

B21t—8 to 12 inches, reddish-brown (5YR 4/4) heavy loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, subangular blocky and angular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium roots; few, fine, discontinuous, random, inped pores; common thin clay films on peds and in pores; 10 percent gravel; slightly acid; clear, wavy boundary.

B22t—12 to 18 inches, yellowish-red (5YR 5/6) light sandy clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine and medium roots; common, fine, discontinuous, random pores; common thin clay films on ped surfaces and in pores; neutral; abrupt, smooth boundary.

R—18 inches, light-red (2.5YR 6/6) fractured and weathering calcareous sandstone, red (2.5YR 4/6) when moist.

The A1 horizon ranges from brown to dark brown or reddish brown in hues of 10YR to 5YR. Texture is dominantly loam but ranges to cobbly loam. In places the A horizon is as much as 20 percent cobblestones and gravel. Reaction is medium acid to neutral. Thickness ranges from 8 to 11 inches. The B2t horizon ranges from reddish brown or yellowish red to red in hues of 5YR and 2.5YR. It ranges from loam to light clay loam and in places is as much as 20 percent gravel.

Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. These soils hold 3.5 to 4 inches of available water above the bedrock. Some roots extend into cracks in the bedrock, but most roots are within a depth of 20 inches.

Included in mapping were areas of Hoskin cobbly loam, 10 to 30 percent slopes; Agassiz rocky silt loam, 6 to 30 percent slopes; and Lucky Star silt loam, 6 to 20 percent slopes. The Hoskin and Agassiz soils are on spur ridges. The Lucky Star soil has slopes that face east, and the vegetation on it is aspen.

Soils in this mapping unit are used for range, watershed, and wildlife habitat. (Curtis Creek soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. Goring soil is in capability unit VIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Curtis Creek-Goring association, steep (30 to 60 percent slopes) (CSG).—This mapping unit consists of soils in the vicinity of Rock Creek, northeast of Hardware Ranch. About 50 percent of the association is Curtis Creek loam, 30 to 60 percent slopes; 25 percent is Goring silt loam, 30 to 60 percent slopes; 20 percent is Lucky Star gravelly silt loam, 30 to 60 percent slopes; and about 5 percent is included soils. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

The Curtis Creek soil is in very steep mountain areas that face south, east, and west. The surface layer is 8 to 10 inches thick. The vegetation is sagebrush and grass.

The topography of the Goring soil is generally the same as the Curtis Creek soil, except that the soil is in concave areas.

The Lucky Star is on north-facing slopes of mountains. The vegetation is aspen.

Included in mapping were areas of Curtis Creek loam, 10 to 30 percent slopes, and areas of rock outcrop.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Curtis Creek soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3. Goring soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3. Lucky Star soil is in capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; not in a woodland suitability group; wildlife suitability group 3)

Dagor Series

The Dagor series consists of well-drained soils that formed in recent alluvium that was derived from sandstone rocks and was washed from the eroded surface layer of the adjacent upland soils. Dagor soils are mainly on alluvial fans along the foothills on the east side of Wellsville Mountain. The elevation ranges from 4,900 to 5,150 feet. Slopes range from 4 to 20 percent. The vegetation is sagebrush, scrubby maple, and wheatgrasses. The average annual precipitation is 17 to 18 inches, the mean annual air temperature is 46° to 47° F., and the frost-free season is 120 to 140 days. Dagor soils are most commonly associated with Crowshaw and Hendricks soils.

In a representative profile, the soil is dark grayish-brown to brown, slightly acid to neutral silt loam that extends to a depth of 60 inches or more.

Dagor soils are used for dryland crops of alfalfa and small grain.

Dagor silt loam, 10 to 20 percent slopes (DaD).—This soil is on the upper part of alluvial fans, mostly south of the town of Wellsville.

Representative profile, 1,400 feet south and 500 feet west of the northeast corner of the northwest quarter of sec. 27, T. 10 N., R. 1 W.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; common medium and fine roots; few medium pores; neutral; clear, smooth boundary.

A11—5 to 14 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and plastic; many fine roots; common fine and medium pores; slightly acid; gradual, wavy boundary.

A12—14 to 34 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky structure; soft, friable, nonsticky and slightly plastic; many fine roots; few large pores and common medium pores; neutral; gradual, wavy boundary.

AC—34 to 46 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) when moist; weak, fine subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; common medium pores and many fine pores; slightly acid; clear, wavy boundary.

C—46 to 60 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and plastic; common fine roots; common medium pores and many fine pores; neutral.

The A horizon ranges from dark grayish brown to brown. Its texture is silt loam to loam. Thickness ranges from 20 to 36 inches. The C horizon ranges from brown to yellowish brown in hues of 7.5YR and 10YR. It is silt loam to loam and in places is as much as 40 percent gravel. Reaction is slightly acid to neutral.

This soil is easy to till. Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of a soil that has slopes of 5 to 10 percent and a few small areas of a soil that has slopes of slightly more than 20 percent.

This Dagor soil is used almost entirely for dryland crops of alfalfa and winter wheat. (Capability unit IVe-2, irrigated, IVe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Dagor silt loam, 4 to 8 percent slopes (DaC).—This soil is on the lower part of alluvial fans along the foothills of the Wellsville Mountains. In places the substratum, below a depth of 36 inches, is as much as 40 percent sandstone gravel. The pebbles are mostly less than 1 inch in diameter. In places small amounts of gravel are scattered throughout the profile. Runoff is slow to medium, and the hazard of erosion is slight.

Included in mapping were small areas of Hendricks silt loam, 3 to 6 percent slopes, and Crowshaw gravelly loam, 3 to 6 percent slopes. Also included were small areas of gravelly and cobbly soils that are on the upper part of fans.

This Dagor soil is used almost entirely for dryland crops of alfalfa and winter wheat. (Capability unit IIIe-2, irrigated, IIIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Dateman Series

The Dateman series consists of well-drained soils that formed in residuum and colluvium derived from limestone. These soils are underlain by bedrock at a depth of 26 to 40 inches. They are steep to very steep and are on north- and east-facing slopes at elevations of 6,200 to 9,000 feet. Slopes range from 40 to 70 percent. The vegetation is Douglas-fir and alpine fir. The average annual precipitation is 25 to 35 inches, the mean annual air temperature is 35° to 40° F., and the mean soil temperature in summer is less than 60°. The frost-free season is 70 to 90 days. Dateman soils are most commonly associated with Agassiz, Bradshaw, Smarts, Elwood, and Lucky Star soils.

In a representative profile, the surface layer is dark-brown to brown, neutral cobbly silt loam about 24 inches thick. The subsoil is brown to dark-brown, mildly alkaline very cobbly silty clay loam about 10 inches thick. Limestone bedrock is at a depth of about 34 inches.

Representative profile of Dateman cobbly silt loam in an area of Agassiz-Dateman association, eroded, in Paradise Dry Canyon, 1,700 feet east of the west quarter corner of sec. 5, T. 9 N., R. 2 E.:

O1—2 inches to 0, decomposing needles and twigs.

A11—0 to 14 inches, dark-brown to brown (10YR 4/3) cobbly silt loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many fine roots, common medium roots, and few large roots; 20 percent cobblestones; neutral; gradual, wavy boundary.

A12—14 to 24 inches, brown (10YR 5/3) cobbly heavy silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots and few medium and large roots; 40 to 50 percent cobblestones; neutral; gradual, irregular boundary.

B2—24 to 34 inches, brown to dark-brown (7.5YR 4/4) very cobbly light silty clay loam, dark brown (7.5YR 3/4) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and plastic; few fine, medium, and large roots; many very fine, discontinuous, interstitial pores; few thin clay films in pores and on ped surfaces; 70 percent cobblestones; noncalcareous; mildly alkaline; abrupt, irregular boundary.

R—34 inches, fractured weathering limestone bedrock that has some B2 material in the larger cracks and accumulations of calcium carbonate on the undersides of rock fragments.

The combined thickness of the A1 and B2t horizons over the fractured limestone bedrock ranges from 26 to 40 inches. The content of cobblestones and gravel generally increases with increasing depth.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. These soils hold 4 to 5 inches of available water above the bedrock. Roots are mostly within a depth of 27 to 40 inches, but some extend into cracks in the bedrock.

Dateman-Bradshaw association (30 to 70 percent slopes) (DHG).—This mapping unit consists of soils in the vicinity of Davenport Creek on mountains that have many spur ridges. About 60 percent of the association is Dateman cobbly silt loam, 40 to 70 percent slopes; 30 percent is Bradshaw silt loam, 30 to 60 percent slopes; and about 10 percent is included soils.

The Dateman soil is steep and very steep, and it has north- and east-facing slopes. The Bradshaw soil is in slightly concave areas between spur ridges.

Included in mapping were areas of Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and Mult silt loam, 30 to 50 percent slopes. The Agassiz soil is on convex ridges, where the vegetation is curlleaf mountain-mahogany and various browse plants. The Mult soil is in concave areas, where the vegetation is aspen.

Soils of this mapping unit are used for range, wildlife habitat, woodland, and watershed. (Dateman soil is in capability unit VIIe-HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4. Bradshaw soil is in capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Dateman extremely rocky silt loam, 40 to 80 percent slopes (DEG).—This very steep mapping unit is on north-facing canyon walls that dissect mountains, mostly in the Blacksmith Fork Canyon and on the Wellsville Mountains. It is about 40 to 60 percent Dateman cobbly silt loam, 40 to 70 percent slopes; 30 percent Rock land and rock outcrop; and 10 percent included soils.

The Dateman soil is in slightly concave areas between areas of Rock land and rock outcrop. This soil is similar to Dateman cobbly silt loam, 40 to 70 percent slopes, described under the series. Slopes are dominantly 60 to 70 percent. The vegetation is Douglas-fir and alpine fir and a sparse understory of chokecherry, snowberry, Oregon grape, and mountain-myrtle.

Rock land and rock outcrop are dominantly limestone. Rock land has slopes of 60 to 80 percent or more. Some of the rock outcrop is in perpendicular cliffs, and rock ledges are common.

Included in mapping were areas of Agassiz soils.

This soil is used for watershed and wildlife habitat. The wooded areas have not been used extensively, because the landscape is rough and harvesting is difficult. (Capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4x1; wildlife suitability group 4)

Datwyler Series

The Datwyler series consists of well-drained soils that formed in residuum and colluvium derived from limestone and calcareous sandstone rocks. These soils are on south- and west-facing mountain areas at elevations of 5,000 to 7,000 feet. Slopes range from 30 to 60 percent. The vegetation is bluebunch wheatgrass, native bluegrass, slender wheatgrass, lupine, big sagebrush, and serviceberry. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 40° to 45° F., and the frost-free season is 90 to 110 days. Datwyler soils are associated with Maughan, Elzinga, Sheep Creek, and Agassiz soils.

In a representative profile, the surface layer is brown, neutral cobbly silty clay loam about 4 inches thick. The subsoil is brown and reddish brown, neutral very cobbly clay about 24 inches thick. The substratum is pink, strongly calcareous, mildly alkaline very cobbly sandy clay loam. Bedrock is at a depth of about 35 inches. Carbonates have been leached from the surface layer and subsoil. A distinct horizon of carbonate accumulation is at a depth of 24 to 35 inches.

Datwyler soils are used for range, watershed, and wildlife habitat.

Datwyler cobbly silty clay loam, 30 to 60 percent slopes (DLG).—This soil is in south-facing mountain areas, mainly south and west of the town of Wellsville.

Representative profile, located 3 miles south of Wellsville, 300 feet west and 1,000 feet south of the north quarter corner of sec. 27, T. 10 N., R. 1 W:

A1—0 to 4 inches, brown (7.5YR 4/2) cobbly heavy silty clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and plastic; common fine and medium roots; 40 to 50 percent cobblestones and gravel; neutral; clear, wavy boundary.

B1—4 to 11 inches, brown (7.5YR 4/2) very cobbly clay, dark brown (7.5YR 3/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; common fine and medium interstitial and tubular pores; 60 percent cobblestones and gravel; neutral; clear, wavy boundary.

B2t—11 to 28 inches, reddish-brown (5YR 5/4) very cobbly clay, reddish-brown (5YR 4/4) when moist; moderate, medium, prismatic structure that parts to strong, medium, subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; few fine interstitial pores; thin continuous clay films; 70 percent cobblestones and gravel; neutral; clear, wavy boundary.

Cca—28 to 35 inches, pink (7.5YR 7/4) very cobbly sandy clay loam, light brown (7.5YR 6/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; 90 percent cobblestones and gravel; strongly calcareous; mildly alkaline.

R—35 inches, fractured limestone bedrock that has streaks of lime in cracks and on rocks.

The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Texture ranges from cobbly heavy silty clay loam to cobbly heavy loam. Reaction is slightly acid to neutral. Thickness ranges from 4 to 10 inches. The B1 horizon ranges from brown to dark brown. Texture is very cobbly heavy clay loam or very cobbly clay. The B2t horizon ranges from reddish brown to brown or strong brown in a dominant hue of 5YR or 7.5YR. Texture is dominantly very cobbly clay but ranges to very cobbly heavy clay loam. Reaction is slightly acid to neutral. The Cca horizon ranges from pink to light brown in a hue of 7.5YR or 5YR. Reaction ranges from mildly alkaline to strongly alkaline. The depth to limestone bedrock ranges from 32 to 40 inches. Pebbles and cobblestones are present throughout the profile and generally increase with depth. The content of coarse fragments ranges from 30 to 50 percent in the A1 horizon, 40 to 60 percent in the B1 horizon, 50 to 80 percent in the B2t horizon, and 70 to 95 percent in the C horizon.

Permeability is moderately slow. Runoff is rapid to very rapid and the hazard of erosion is high to very high. This soil holds 3 to 5 inches of available water above the bedrock. Most roots are above the bedrock, but some extend into cracks to depths of 4 feet or more.

Included in mapping were small areas of Sheep Creek cobbly loam, 30 to 70 percent slopes, and Agassiz cobbly silt loam, 30 to 60 percent slopes.

This Datwyler soil is used for range, watershed, and wildlife habitat. (Capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Datwyler-Elzinga-Maughan association (30 to 60 percent slopes) (DNG).—This mapping unit consists of soils in the foothills of mountains south of Wellsville and in areas on the north end of Wellsville Mountain. About 40 percent of the association is Datwyler cobbly silty clay loam; 30 percent is Elzinga silt loam, 30 to 60 percent slopes; 20 percent is Maughan silt loam, 30 to 60 percent slopes; and 10 percent is included soils.

The Datwyler soil mainly has slopes that face south, and the vegetation is mostly bluebunch wheatgrass, cheatgrass, sagebrush, balsamroot, bitterbrush, and yellowbrush. The Datwyler soil in this mapping unit is similar to Datwyler cobbly silty clay loam, 30 to 60 percent slopes.

The Elzinga and Maughan soils are very steep and mostly have slopes that face north. The Maughan soil is described under the Maughan series. Vegetation on these soils is dominantly maple, but there are scattered aspen trees and a sparse understory of chokecherry, wheatgrass, false Solomons-seal, and fern.

Included in mapping were areas of deep, gravelly, medium-textured soils that formed in alluvium.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Datwyler soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Elzinga and Maughan soils are in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. None of these soils is in a woodland suitability group. All are in wildlife suitability group 3)

Despain Series

The Despain series consists of well-drained soils that formed in residuum and colluvium derived from sandstone, quartzite, and limestone. These soils are in dominantly south- and west-facing mountain areas. In the Clarkston Mountain area, however, slopes face east and north. Elevations range from 5,500 to 8,000 feet. Slopes range from 20 to 70 percent. The vegetation is bluebunch wheatgrass, tall native bluegrass, big sagebrush, yellowbrush, bitterbrush, ceanothus, ninebark, and serviceberry. The average annual precipitation is 20 to 25 inches, the mean annual temperature is 38° to 44° F., and the frost-free season is 80 to 100 days. Despain soils are associated with Ant Flat, Lucky Star, Bickmore, and Sheep Creek soils.

In a representative profile, the surface layer is brown to dark-brown, slightly acid to neutral gravelly loam about 16 inches thick. The subsoil is brown to dark-brown, neutral gravelly clay loam about 14 inches thick. The substratum, to a depth of 60 inches or more, is reddish-yellow, strongly calcareous, mildly alkaline gravelly loam. Carbonates have been leached from the surface layer and upper part of the subsoil and redeposited in the lower part of the subsoil and the substratum.

Despain soils are used for range, wildlife habitat, and watershed.

Despain-Lucky Star association (30 to 70 percent slopes) (DSG).—This mapping unit consists of soils on mountains east of Ant Flat. About 60 percent of the association is Despain gravelly loam, 30 to 70 percent slopes; 30 percent is Lucky Star gravelly silt loam, 30 to 60 percent slopes; and about 10 percent is included soils.

The Despain soil is in broad, open, west- and south-facing areas, where the vegetation is shrubs and grasses. The Lucky Star soil is in north- and east-facing areas. Here, the vegetation is aspen.

Representative profile of Despain gravelly loam, 30 to 70 percent slopes, in an area of Despain-Lucky Star association, 8 miles south of Hardware Ranch and 1 mile east of the road, 200 feet west of the east quarter corner of sec. 26, T. 9 N., R. 3 E.:

A11—0 to 9 inches, brown to dark-brown (7.5YR 4/3) gravelly loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, very friable, non-sticky and slightly plastic; many fine, medium, and large roots; 20 percent gravel and cobblestones; slightly acid; gradual, wavy boundary.

A12—9 to 16 inches, brown to dark-brown (7.5YR 4/3) gravelly loam, very dark brown (7.5YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; many fine, medium, and large roots; many, fine, random, interstitial pores; 20 percent gravel and cobblestones; neutral; gradual, wavy boundary.

B21t—16 to 23 inches, brown to dark-brown (7.5YR 4/3) gravelly light clay loam, very dark brown (7.5YR 2/2) when moist; moderate, medium and coarse, subangular blocky structure that parts to weak, fine, subangular blocky structure; slightly hard, firm, slightly sticky and plastic; many fine and medium roots; many, fine, random, interstitial pores; thin continuous clay films; 30 percent gravel and cobblestones; neutral; gradual, wavy boundary.

B22t—23 to 30 inches, brown (7.5YR 5/4) gravelly light clay loam, dark brown (7.5YR 3/2) when moist; weak, coarse, subangular blocky structure that parts to weak, fine, subangular blocky structure; slightly hard, firm, slightly sticky and plastic; common fine and medium roots; many, fine, random, interstitial pores; common thin clay films; 30 percent gravel and cobblestones; neutral; gradual, wavy boundary.

Cca—30 to 60 inches, reddish-yellow (5YR 6/6) gravelly heavy loam, yellowish red (5YR 4/6) when moist; massive; slightly hard, firm, nonsticky and slightly plastic; few fine and medium roots; many fine pores; 40 percent gravel and cobblestones; strongly calcareous; mildly alkaline.

The combined thickness of the A1 and B2t horizons ranges from 24 to 38 inches over the Cca horizon. The A1 horizon ranges from brown to dark brown or reddish brown in a hue of 10YR, 7.5YR, or 5YR. This horizon ranges from gravelly loam to loam and is 10 to 30 percent gravel and cobblestones. Reaction ranges from slightly acid to mildly alkaline. Thickness ranges from 12 to 17 inches. The B2t horizon ranges from brown or dark brown to yellowish brown or reddish brown in a hue of 10YR, 7.5YR, or 5YR. Texture is cobbly and gravelly light clay loam or cobbly and gravelly heavy loam. Reaction is slightly acid to mildly alkaline. Thickness ranges from 8 to 20 inches. The Cca and C horizons range from reddish yellow to yellowish brown or brown in hues of 10YR to 5YR. Texture ranges from cobbly and gravelly loam to very cobbly and gravelly clay loam. Reaction is mildly alkaline to moderately alkaline. These horizons are moderately calcareous to strongly calcareous.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 6 to 9 inches of available water to a depth of 5 feet. Roots extend to a depth of 4 feet or more.

Included in mapping where areas of Scave silt loam, 10 to 30 percent slopes, and Sheep Creek cobbly loam, 30 to 70 percent slopes. The Scave soil is in north- and east-facing areas, where the vegetation is aspen. The Sheep Creek soil is in west-facing areas, where the vegetation is shrubs and grasses.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Despain soil is in capability unit VIIe-M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3. Lucky Star is in capability unit VIIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2r1; wildlife suitability group 4)

Despain-Bickmore association (30 to 70 percent slopes) (DPG).—This mapping unit is on the east side of Clarkston Mountain. About 50 percent of it is Despain gravelly loam, 30 to 70 percent slopes; 35 percent is Bickmore gravelly silt loam, 30 to 60 percent slopes; and about 15 percent is included soils.

The Despain soil is in open areas, where the vegetation is brush, forbs, and grasses. The vegetation on the Bickmore soil is a dense stand of conifers but only a sparse understory.

Included in mapping were areas of Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, Picayune gravelly loam, 50 to 80 percent slopes, and Smarts gravelly loam, 30 to 70 percent slopes.

Soils of this mapping unit are used for range, wildlife habitat, and watershed. (Despain soil is in capability unit VIIe-M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3. Bickmore soil is in capability unit VIIe-HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Elwood Series

The Elwood series consists of well-drained soils that formed in residuum derived chiefly from limestone. These soils are on mountains at elevations of 7,500 to 9,000 feet. Slopes range from 10 to 60 percent. The vegetation is Douglas-fir, alpine fir, and Engelmann spruce. The average annual precipitation is 25 to 35 inches, the mean annual temperature is 32° to 42° F., and the mean soil temperature in summer is less than 60°. The frost-free season is 75 to 90 days. Elwood soils are associated with Mult, Dateman, and Agassiz soils.

In a representative profile, the surface layer is brown, medium acid heavy silt loam about 11 inches thick. The subsoil is brown, neutral cobbly and very cobbly silty clay loam about 27 inches thick. Fractured limestone is at a depth of about 38 inches.

The Elwood soils are used mainly for watershed and wildlife habitat. Wood products have been harvested in a few places.

Elwood silt loam, 30 to 60 percent slopes (EDG).—This soil is in dominantly north- and east-facing areas near the head of Paradise Dry Canyon and also in the vicinity of Beaver Mountain.

Representative profile, 2 miles south and 1 mile east of Beaver Mountain, about 2,000 feet north and 2,000 feet east of the southwest corner of sec. 20, T. 14 N., R. 4 E.:

O1—2 inches to 0, fir needles and twigs.

A1—0 to 11 inches, brown (10YR 5/3) heavy silt loam, dark brown (7.5YR 3/3) when moist; moderate, medium, subangular blocky structure that parts to moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots and few large roots; few, fine, discontinuous, random, inped pores; medium, acid; clear, wavy boundary.

B21t—11 to 26 inches, brown (7.5YR 5/4) cobbly silty clay loam, brown to dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and slightly plastic; common fine and medium roots; few, fine, discontinuous, random, inped pores; common thin clay films in pores and on ped surfaces; 20 percent cobblestones; neutral; clear, wavy boundary.

B22t—26 to 38 inches, brown (7.5YR 5/4) very cobbly light silty clay loam, brown to dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and medium roots; few fine pores; common thin clay films; 80 percent cobblestones and gravel-size limestone rock fragments; neutral.

R—38 inches, fractured limestone.

The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. This horizon is dominantly heavy silt loam but is loam in places and has a gravel content of 5 to 20 percent. Reaction is slightly acid to medium acid. Thickness ranges from 10 to 12 inches. The B2t horizon ranges from brown to pale brown or light brown in a hue of 10YR or 7.5YR. Its texture ranges from cobbly silty clay loam to cobbly heavy loam in the upper part of the horizon to very cobbly silty clay loam in the lower part. The content of cobblestones and gravel is 20 to 50 percent in the upper part of the horizon and 50 to 80 percent in the lower part. Depth to bedrock is 20 to 40 inches.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 4 to 6 inches of available water above the bedrock. Roots are mostly above the limestone, but some roots extend into cracks in the rocks.

Included in mapping were areas of moderately deep, well-drained silty clay loam soils and areas of Agassiz rocky loam, 30 to 70 percent slopes, eroded. The silty clay loams make up 7 percent of the mapping unit, and the Agassiz soil makes up 3 percent.

This Elwood soil is used for watershed, woodland, and wildlife habitat. (Capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Elwood-Agassiz association (6 to 30 percent slopes) (EGE).—This mapping unit is in broken areas near the crest of mountains at the head of Hyrum Dry Canyon. Slopes are dominantly 10 to 20 percent. The rock formations are tilted, and the rocky ridges are long and narrow. These ridges are generally oriented in a north-south direction. About 55 percent of the association is Elwood silt loam, 10 to 30 percent slopes; 35 percent is Agassiz rocky silt loam, 6 to 30 percent slopes; and 10 percent is included soils.

The Elwood soil is in pockets and somewhat concave areas between rocky ridges. The depth to limestone bedrock is 28 to 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

The Agassiz soil is on the southern and southwestern exposures of ridges. The vegetation is big sagebrush and some curlleaf mountain-mahogany.

Included in mapping were areas of Goring silt loam, 6 to 8 percent slopes, and Obray silty clay loam, 6 to 20 percent slopes. The Goring soil is on southwestern exposures and has a cover of big sagebrush and snowberry. The Goring soil makes up about 8 percent of the mapping unit and Obray soil 2 percent.

The soils of this mapping unit are used for range, woodland, watershed, and wildlife habitat. (Elwood soil is in capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Elwood-Mult association, hilly (6 to 30 percent slopes) (EME).—This mapping unit consists of moderately steep soils on mountains east of the Logan River, near Beaver Mountain in the Franklin Basin area. The underlying rock formations are limestone and a small amount of interbedded quartzite. About 70 percent of the association is Elwood silt loam, 10 to 30 percent slopes; 20 percent is Mult silt loam, 6 to 30 percent slopes; and 10 percent is included soils.

The Elwood soil has slopes that mainly face north and east, where the vegetation is Douglas-fir and alpine fir. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Depth to limestone bedrock ranges from 28 to 40 inches.

The Mult soil has slopes that mainly face south and west. Here, the vegetation is aspen.

Included in mapping were areas of Agassiz rocky silt loam, 6 to 30 percent slopes. This soil has dominantly southern and western exposures, and vegetation on the ridges is big sagebrush.

Soils of this mapping unit are used for watershed, range, woodland, and wildlife habitat. (Elwood soil is in capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4. Mult soil is in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Elwood-Mult association, steep (30 to 60 percent slopes) (EMG).—This mapping unit lies both east and west of the Logan River in the Franklin Basin and Beaver Mountain area. The soils have all exposures in the mountains. About 70 percent of the association is Elwood silt loam, 30 to 60 percent slopes; 20 percent is Mult silt loam, 30 to 50 percent slopes; and about 10 percent is included soils.

The Elwood soil has slopes that face north and east, and the vegetation on it is conifers. The Mult soil is in concave areas or small basins, and the vegetation on it is aspen.

Included in mapping were small areas of Agassiz rocky silt loam, 30 to 70 percent slopes, eroded, and Bradshaw silt loam, 30 to 60 percent slopes. The Agassiz soil is on the ridges, where the vegetation is mostly big sagebrush and low sagebrush. The Bradshaw soil is in basins under snowberry and ceanothus.

The soils of this mapping unit are used for watershed, range, woodland, and wildlife habitat. (Elwood soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4. Mult soil is in capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2r1; wildlife suitability group 4)

Elzinga Series

The Elzinga series consists of well-drained soils that formed in residuum and colluvium derived from sandstone and limestone. These soils are on dominantly north- and east-facing mountains at elevations of 5,000 to 7,500 feet. Slopes range from 10 to 60 percent. The vegetation is maple and scattered aspen and an understory of mountain brome, slender wheatgrass, and forbs. The average annual precipitation is 20 to 25 inches, the mean annual temperature is 42° to 45° F., and the frost-free season is 90 to 110 days. Elzinga soils are associated with Maughan, Datwyler, Sheep Creek, and Agassiz soils.

In a representative profile, the surface layer is very dark gray, slightly acid silt loam about 22 inches thick. The subsurface layer is brown to pale-brown, slightly acid silt loam and cobbly silt loam about 26 inches thick. The next layer is pale-brown to dark-brown, slightly acid very cobbly very fine sandy loam to a depth of 60 inches or more.

Elzinga soils are used for watershed, range, and wildlife habitat.

Representative profile of Elzinga silt loam, 30 to 60 percent slopes, in an area of Datwyler-Elzinga-Maughan association, 3 miles south of Wellsville, 1,200 feet south and 2,000 feet east of the northwest corner of sec. 27, T. 10 N., R. 1 W.:

O1—1 inch to 0, partially decomposed leaves and twigs.

A1—0 to 22 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine, medium, and large roots; slightly acid; gradual, smooth boundary.

A21—22 to 26 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many fine and medium interstitial pores; slightly acid; clear, smooth boundary.

A22—26 to 48 inches, pale-brown (10YR 6/3) cobbly silt loam, brown to dark brown (10YR 4/3) when moist; massive; slightly hard, friable, sticky and slightly plastic; many fine and medium roots; many fine and medium interstitial pores; 30 percent cobblestones and gravel; slightly acid; gradual, smooth boundary.

A2&B2t—48 to 62 inches, about 70 percent A2 horizon and 39 percent B2t horizon. The A2 part is pale-brown (10YR 6/3) very cobbly very fine sandy loam, brown to dark brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic. The B2t part is brown (7.5YR 5/4) very cobbly clay loam, dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; many fine and medium roots; many fine and medium interstitial pores; thin continuous clay films; 60 percent cobblestones and gravel; slightly acid; gradual, wavy boundary.

R—62 inches, fractured sandstone; material from B2t horizon extends in cracks; more than 90 percent sandstone rock.

The O1 horizon ranges from ½ inch to 2 inches in thickness. The combined thickness of the A1, A2, and B2t horizons is more than 60 inches. Coarse fragments are mostly cobblestones and gravel-size, angular sandstone rock fragments; their content ranges from 30 to 50 percent in the upper A2 horizon and 50 to 60 percent in the lower A2 and B2t horizons. The A1 horizon ranges from very dark gray to very dark grayish brown in a hue of 10YR. This horizon is dominantly silt loam but ranges to loam and is as much as 15 percent gravel. Reaction is slightly acid to medium acid. Thickness ranges from 20 to 26 inches. The A2 horizon has a hue of 10YR or 7.5YR. Texture ranges from silt loam or cobbly silt loam to cobbly very fine sandy loam. Reaction is slightly acid to medium acid. The A2 horizon tongues into the B2t horizon. The B2t horizon ranges from brown to light brown. It ranges from very cobbly clay loam to very cobbly loam and is 50 to 60 percent cobblestones and gravel. Reaction is slightly acid to medium acid.

Permeability of the Elzinga soils is moderate to moderately rapid. Runoff is rapid or very rapid, and the hazard of erosion is high or very high. These soils hold from 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate readily to a depth of 5 feet or more.

In this survey area, Elzinga soils are not mapped separately but are mapped only in associations with Datwyler, Maughan, and Hoskin soils.

Fitzgerald Series

The Fitzgerald series consists of well-drained soils that formed in residuum, colluvium, and glacial till materials derived from quartzite and some limestone. These soils are in dominantly north-facing mountain areas at elevations of 7,300 to 8,500 feet. Slopes range from 10 to 20 percent. The vegetation is Douglas-fir, alpine fir, and Engelmann spruce and an understory of shrubs and grasses. The average annual precipitation is 25 to 35 inches, the mean annual air temperature is 34° to 40° F., and the mean soil temperature in summer is less than 60°. The frost-free season is 70 to 80 days. Fitzgerald soils are associated with Lucky Star, Scout, and Elwood soils.

In a representative profile, the surface layer is brown, strongly acid extremely stony loam about 8 inches thick. The subsurface layer is brown, strongly acid gravelly loam about 17 inches thick. The subsoil is pale-brown, strongly acid very gravelly sandy clay loam about 12 inches thick. The substratum, to a depth of 60 inches or more, is light brownish-gray, medium acid very gravelly fine sandy loam.

Fitzgerald soils are used for watershed, woodland, range, and wildlife habitat.

Fitzgerald extremely stony loam, 10 to 20 percent slopes (FGD).—This soil is on mountain foot slopes in the Franklin Basin area.

Representative profile, one-fourth mile north of Crescent Lake, 1,280 feet north of the southeast corner of sec. 5, T. 14 N., R. 3 E.:

O1—1 inch to 0, needles and twigs.

A1—0 to 8 inches, brown (10YR 4/3) extremely stony loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; common fine and medium roots and few large roots; 10 percent cobblestones and gravel and 5 percent stones; strongly acid; clear, wavy boundary.

A2—8 to 18 inches, brown (10YR 5/3) gravelly light loam, dark brown to brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure that parts to moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots and few large roots; 20 percent cobblestones and gravel and 5 percent stones; strongly acid; gradual, wavy boundary.

A2&B2t—18 to 25 inches, 60 percent is similar to the A2 horizon, except that it is more cobbly, and 40 percent is the same as the B2t horizon.

B2t—25 to 37 inches, pale-brown (10YR 6/3) very gravelly sandy clay loam, brown (10YR 5/3) when moist; weak, medium and fine, subangular blocky structure; hard, firm, slightly sticky and plastic; common thin clay films on peds and in pores; 65 percent cobblestones and gravel and 5 percent stones; strongly acid; gradual, wavy boundary.

IIC1—37 to 60 inches, light brownish-gray (10YR 6/2) very gravelly fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; 70 percent gravel and cobblestones and a few stones; medium acid.

The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Reaction is medium acid to strongly acid. Thickness ranges from 6 to 9 inches. Stone content ranges from 5 to 15 percent. The A2 horizon ranges from brown to pale brown or very pale brown in a hue of 10YR or 7.5YR. Texture ranges from gravelly sandy loam or gravelly light loam to extremely stony sandy loam or very cobbly sandy loam. The A2 horizon is 20 to 70 percent gravel and cobblestones and is as much as 5 percent stones in places. Thickness ranges from 9 to 16 inches. The B2t horizon ranges from pale brown to brown in a hue of 10YR or 7.5YR. Texture ranges from very gravelly sandy clay loam to extremely stony sandy clay loam or very gravelly heavy loam. The B2t horizon is 50 to 70 percent cobblestones and gravel and is as much as 5 percent stones in places.

Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. This soil holds 5 to 7.5 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were areas of Goring silt loam, 6 to 30 percent slopes. This included soil makes up about 2 percent of the total acreage.

This Fitzgerald soil is used for range, woodland, watershed, and wildlife habitat. (Capability unit VIIs–HXC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4x1; wildlife suitability group 4)

Flygare Series

The Flygare series consists of well-drained soils that formed in alluvium and colluvium derived from quartzite sandstone and limestone. These soils are alluvial fans, old flood plains, and moraines at elevations of 6,300 to 8,000 feet. Slopes range from 3 to 20 percent. The vegetation is aspen and an understory of slender wheatgrass, Sandberg bluegrass, mulesear dock, big sagebrush, elderberry, and chokecherry. The average annual precipitation is 25 to 30 inches, the mean annual air temperature is 36° to 40° F., and the mean soil temperature in summer is less than 60°. The frost-free season is 70 to 90 days. Flygare soils are associated with Lucky Star, Goring, and Yeates Hollow soils.

In a representative profile, the surface layer is dark grayish-brown and grayish-brown, slightly acid silt loam and cobbly silt loam about 27 inches thick. The subsurface layer is light yellowish-brown, medium acid very cobbly very fine sandy loam about 12 inches thick. The subsoil is light yellowish-brown, medium acid cobbly sandy clay loam about 8 inches thick. The substratum, to a depth of 60 inches or more, is pale-brown, slightly acid very cobbly heavy sandy loam.

Flygare soils are used for range, watershed, and wildlife habitat.

Flygare silt loam, 3 to 20 percent slopes (FLD).—This soil is on slightly convex, old flood plains and alluvial fans near the Logan River in the Franklin Basin area.

Representative profile, 720 feet west and 1,360 feet north of the southeast corner of sec. 23, T. 14 N., R. 3 E.:

A11—0 to 13 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and fine roots, common medium roots; and few large roots; slightly acid; clear, smooth boundary.

A12—13 to 27 inches, grayish-brown (10YR 5/2) cobbly silt loam, dark brown (10YR 3/3) when moist; weak, coarse, subangular blocky structure that parts to moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots, common medium roots, and few large roots; 30 percent cobblestones and stones; slightly acid; abrupt, irregular boundary.

A2—27 to 39 inches, light yellowish-brown (10YR 6/4) very cobbly very fine sandy loam, brown (7.5YR 4/3) when moist; weak, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine and medium roots; 40 percent cobblestones and about 5 percent stones; medium acid; clear, irregular boundary.

B2t—39 to 47 inches, light yellowish-brown (10YR 6/4) cobbly sandy clay loam, brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few fine and medium roots; common thin clay films; about 40 percent cobblestones and 2 to 3 percent stones; medium acid; clear, wavy boundary.

C1—47 to 65 inches, pale-brown (10YR 6/3) very cobbly heavy sandy loam, brown (7.5YR 4/4) when moist; massive; slightly hard, loose, very friable, slightly sticky and nonplastic; few fine and medium roots; 60 percent cobblestone and gravel; slightly acid.

The A1 horizon ranges from dark grayish brown or grayish brown to brown in a hue of 10YR or 7.5YR. Texture is loam to silt loam or cobbly silt loam. Reaction is strongly acid to slightly acid. Thickness ranges from 21 to 30 inches. The A2 horizon ranges from light yellowish brown or brown to pale brown in a hue of 10YR or 7.5YR. Texture ranges from cobbly light loam to very cobbly sandy loam. Reaction is slightly acid to medium acid. Thickness ranges from 9 to 12 inches. A mixed A2 and B2t horizon is present in places where the A2 horizon extends into the B2t horizon. The B2t horizon ranges from light yellowish brown to brown or pale brown in hues of 10YR and 7.5YR. Texture range from cobbly sandy clay loam to gravelly clay loam. The C horizon ranges from pale brown to yellowish brown or brown in hues of 10YR and 7.5YR. Texture ranges from very cobbly sandy loam to very cobbly light loam.

Permeability is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 6 to 8 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of an extremely stony soil.

This Flygare soil is used entirely for range, watershed, and wildlife habitat. (Capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Foxol Series

The Foxol series consists of somewhat excessively drained soils that formed in residuum and colluvium derived from quartzite. These steep and very steep soils are on mountains at elevations of 6,500 to 7,500 feet. Slopes range from 30 to 60 percent. The vegetation is dominantly bluebunch wheatgrass, native bluegrass, low sagebrush, buckwheat, serviceberry, bitterbrush, yarrow, and scattered chokecherry. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 38° to 41° F., and the frost-free season is 80 to 90 days. Foxol soils are associated with Yeates Hollow, Lucky Star, Agassiz, and Hoskin soils.

In a representative profile, the soil is brown and light-brown, slightly acid and medium acid gravelly loam, very gravelly loam, and very gravelly sandy loam about 17 inches thick. Bedrock is at a depth of about 17 inches.

Foxol soils are used for range, watershed, and wildlife habitat.

Foxol rocky loam, 30 to 60 percent slopes (FOG).—This steep to very steep soil is on mountains near Scare Canyon, at the head of the Little Bear River drainage above Mineral Point.

Representative profile one-fourth mile east of old mine at Mineral Point, about 1,600 feet south of the northwest corner of sec. 30, T. 9 N., R. 3 E. (profile described between rock outcrops):

A1—0 to 7 inches, brown (7.5YR 5/3) gravelly loam, dark reddish brown (5YR 3/3) when moist; moderate, fine, granular structure; soft, friable, nonsticky and nonplastic; many fine, medium, and large roots; 30 percent gravel and cobblestones; slightly acid; clear, wavy boundary.

B2—7 to 11 inches, brown (7.5YR 5/4) very gravelly loam, reddish brown (5YR 4/3) when moist; moderate, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; many fine and medium roots; many fine pores; 60 percent gravel and cobblestones; slightly acid; abrupt, wavy boundary.

C—11 to 17 inches, light-brown (7.5YR 6/4) very gravelly sandy loam, brown to dark brown (7.5YR 4/4) when moist; massive; loose, nonsticky and nonplastic; few fine and medium roots; many fine and medium pores; 70 percent gravel and cobblestones; medium acid; abrupt, irregular boundary.

R—17 inches, fractured, weathering quartzite rock.

The A1 horizon ranges from brown to reddish brown in hues of 7.5YR and 5YR. Thickness ranges from 7 to 12 inches. The B2 horizon ranges from brown to light reddish brown in a hue of 7.5YR or 5YR. Texture ranges from very gravelly loam to very gravelly heavy sandy loam. Structure is weak to moderate, fine to coarse, subangular blocky. Reaction is slightly acid to medium acid. Thickness ranges from 4 to 11 inches. The C horizon ranges from light brown to pink in a hue of 7.5YR or 5YR. Texture ranges from very gravelly loam to very gravelly sandy loam. Reaction is slightly acid to medium acid. The coarse fragments are mainly cobblestones and gravel-size angular quartzite fragments. These fragments make up 20 to 50 percent of the A horizon and 50 and 80 percent of the B2 and C horizons.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 2 to 3.5 inches of available water above the bedrock. Roots are mostly in the surface layer, 14 to 20 inches above the quartzite bedrock, but some roots extend into cracks in the rocks.

Included in mapping were areas of Yeates Hollow extremely stony silt loam, 30 to 70 percent slopes, and areas of rock outcrop. The Yeates Hollow soil makes up about 2 percent of the total acreage, and the rock outcrop 5 to 8 percent.

This Foxol soil is used for range, watershed, and wildlife habitat. (Capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Goring Series

The Goring series consists of well-drained soils that formed in colluvium and residuum derived from sandstone, quartzite, and small amounts of limestone. These soils are on mountains at elevations of 5,300 to 7,200 feet. Slopes range from 3 to 60 percent. The vegetation is bluebunch wheatgrass, tall native bluegrass, Great Basin wildrye, prairie junegrass, Columbia needlegrass, yarrow, lupine, yellowbrush, bitterbrush, and big sagebrush. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 38° to 42° F., and the frost-free season is 80 to 100 days. Goring soils are associated with Agassiz, Yeates Hollow, Obray, Curtis Creek, Hoskin, Scave, and Lucky Star soils.

In a representative profile, the surface layer is brown, slightly acid silt loam about 7 inches thick. The upper part of the subsoil is brown and reddish-brown, slightly acid silty clay about 28 inches thick. The lower part of the subsoil is red, slightly acid silty clay loam to a depth of 60 inches or more.

Goring soils are used for range, watershed, and wildlife habitat. Some small areas formerly were cultivated, but are now seeded to grasses. These soils are not suited to cultivated crops, because of the frost hazard.

Goring silt loam, 6 to 30 percent slopes (GGE).—This soil is in the mountains, mainly in the Hardware Ranch-Ant Flat area. Some of the acreage is in the Logan River and Little Bear River drainage areas.

Representative profile, about 2½ miles northeast of Hardware Ranch headquarters, about 1,000 feet south and 1,400 feet west of the northeast corner of sec. 7, T. 10 N., R. 4 E.:

A11—0 to 3 inches, brown (10YR 4/3) silt loam, dark brown (10YR 3/3) when moist; weak, thick, platy structure; soft, friable, slightly sticky and slightly plastic; many fine roots; slightly acid; abrupt, wavy boundary.

A12—3 to 7 inches, brown (10YR 4/3) silt loam, dark brown (10YR 3/3) when moist; moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; slightly acid; clear, wavy boundary.

B1—7 to 13 inches, brown (7.5YR 4/3) light silty clay loam, dark brown (7.5YR 3/3) when moist; moderate, medium and fine, angular blocky structure; hard, firm, friable, sticky and plastic; many fine roots; common, fine, discontinuous, interstitial pores; slightly acid; clear, wavy boundary.

B21t—13 to 22 inches, reddish-brown (5YR 4/3) heavy silty clay loam, dark reddish brown (5YR 3/3) when moist; moderate, coarse, prismatic structure that parts to fine and medium, angular blocky structure; very hard, firm, sticky and plastic; common fine roots; common, fine, discontinuous, interstitial pores; moderately thick continuous clay films; slightly acid; diffused, wavy boundary.

B22t—22 to 35 inches, reddish-brown (5YR 4/4) silty clay, yellowish red (5YR 4/6) when moist; strong, coarse, subangular blocky structure that parts to medium and fine, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; common, fine, discontinuous, interstitial pores; moderately thick continuous clay films; slightly acid; diffused, wavy boundary.

B23t—35 to 60 inches, red (2.5YR 4/6) heavy silty clay loam, dark red (2.5YR 2/6) when moist; moderate, coarse, subangular blocky structure that parts to fine and medium, subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; common, fine, discontinuous pores; moderately thick continuous clay films; slightly acid.

The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Texture ranges from silt loam to clay loam. Reaction is slightly acid to neutral. Thickness ranges from 7 to 14 inches. The B1 horizon ranges from brown to reddish brown in a hue of 5YR, 7.5YR, or 10YR. Texture ranges from silt loam to light silty clay loam. The B1 horizon is 10 to 20 percent gravel and cobblestones in places. Reaction is slightly acid to neutral. Thickness ranges from 3 to 11 inches. The B2t horizon ranges from reddish brown to strong brown or red in a hue of 7.5YR, 5YR, or 2.5YR. Texture ranges from clay or silty clay to heavy silty clay loam.

The soil is fairly easy to till. Permeability is slow. Runoff is slow to moderate, and the hazard of erosion is slight to moderate. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more, but most roots are above the silty clay horizon.

Included in mapping were small areas of Ant Flat loam, 6 to 20 percent slopes; Obray silty clay, 6 to 20 percent slopes; Curtis Creek loam, 10 to 30 percent slopes; and Yeates Hollow extremely stony silt loam, 6 to 30 percent slopes. These inclusions together make up about 8 percent of the mapping unit.

This Goring soil generally is used for range, watershed, and wildlife habitat. Some areas formerly were cultivated but now are mostly reseeded to grasses. Cultivated crops are severely limited because of the frequent frosts late in spring or early in summer. Small grain and alfalfa are grown. None of the acreage is irrigated. (Capability unit VIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Goring-Obray association, eroded (3 to 30 percent slopes) (GOE2).—This mapping unit is west of the Little Bear River, between McMurdie Hollow and Three-Mile Canyon, and also in the Ant Flat and Bear Flat areas south of Hardware Ranch. These gently sloping to steep soils are on broad, gently rolling mountain ridges and eroded old alluvial fans or terraces. About 45 percent of the association is Goring clay loam, 3 to 30 percent slopes, eroded; 25 percent is Obray silty clay, 6 to 20 percent slopes, eroded; 25 percent is Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded; and 5 percent is included soils.

The Goring soil is similar to Goring silt loam, 6 to 30 percent slopes, except that it is moderately eroded and its surface layer is clay loam only 6 to 10 inches thick. Also, the horizon of clay accumulation is at a depth of only 8 to 15 inches. Runoff is medium, and the hazard of erosion is moderate. The vegetation is low sagebrush, mulesear dock, slender wheatgrass, and western wheatgrass.

Included in mapping were areas of Sheep Creek cobbly loam, 30 to 70 percent slopes.

Soils of this association are essentially all used for range, watershed, and wildlife habitat. (Goring soil is in capability unit VIe–M5, nonirrigated; Mountain Clay range site. Obray soil is in capability unit VIe–M5, nonirrigated; Mountain Clay range site. Yeates Hollow soil is in capability unit VIIs–MX5, nonirrigated; Mountain Stony Clay range site. None of the soils is in a woodland suitability group; all soils are in wildlife suitability group 3)

Gravel Pit

Gravel pit (Gp) is a miscellaneous land type that consists of open excavations from which sand and gravel have been removed. Most of the material has been used in building construction and for road subgrade and surfacing. An area near the Hyrum and Newton dams was used as earthfill during their construction. Most of these pits are still in operation and have no farming value. (Capability unit VIIIs–4, nonirrigated; not in a range site, woodland suitability group, or wildlife suitability group)

Green Canyon Series

The Green Canyon series consists of somewhat excessively drained soils that formed in very strongly calcareous alluvium derived from dolomitic limestone. These soils are on alluvial fans deposited on intermediate and high lake terraces at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 7 percent. The vegetation is big sagebrush, gumweed, bluebunch wheatgrass, native bluegrass, and cheatgrass. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 130 to 150 days. Green Canyon soils are associated with Millville, Steed, Sterling, and Ricks soils.

In a representative profile, the surface layer is dark grayish-brown to brown, moderately alkaline gravelly loam about 16 inches thick. The next layer is brown, moderately alkaline, very strongly calcareous very gravelly fine sandy loam about 7 inches thick. This is underlain by light brownish-gray, moderately alkaline, very strongly calcareous very gravelly loamy sand that extends to a depth of 60 inches or more.

Green Canyon soils are used mostly for irrigated cropland. Alfalfa, small grain, and improved pasture are the principal crops.

Green Canyon gravelly loam, 3 to 7 percent slopes (GrB).—This soil is on the upper part of alluvial fans formed at the mouth of Green Canyon east of North Logan. The Green Canyon Forest Nursery is located on this soil. The topography is slightly undulating.

Representative profile, 550 feet east of Green Canyon Forest Nursery shed, 500 feet north and 500 feet west of the center of sec. 24, T. 12 N., R. 1 E.:

A11—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; 20 percent gravel; strongly calcareous; moderately alkaline; gradual, smooth boundary.

A12—9 to 16 inches, brown to dark-brown (7.5YR 4/2) gravelly loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; 20 percent gravel; strongly calcareous; moderately alkaline; clear, smooth boundary.

C1—16 to 23 inches, brown (10YR 5/3) very gravelly fine sandy loam, dark grayish brown (10YR 4/2) when moist; massive; soft, very friable, nonsticky and nonplastic; common fine roots; common fine pores; 50 percent gravel; very strongly calcareous; moderately alkaline; clear, wavy boundary.

IIC2—23 to 60 inches, light brownish-gray (10YR 6/2) very gravelly loamy sand, grayish brown (10YR 5/2) when moist; massive; loose, nonsticky and nonplastic; few fine roots; 70 percent gravel; very strongly calcareous; moderately alkaline.

The A1 horizon is strongly calcareous to very strongly calcareous. Thickness ranges from 11 to 18 inches. The C horizon ranges from brown to light brownish gray or to brown in a hue of 10YR or 7.5YR. Texture ranges from very gravelly fine sandy loam or gravelly fine sandy loam to very gravelly loamy sand. Reaction is moderately alkaline to strongly alkaline. Gravel content ranges from 15 to 35 percent in the surface layer, from 30 to 50 percent in the subsoil, and from 50 to 80 percent in the substratum. In some areas the soil contains some cobblestones on the surface and throughout the profile.

The soil is fairly easy to till, but the gravel causes excessive wear on tillage implements. Permeability is moderately rapid. Runoff is slow, and the erosion hazard is slight. This soil holds 3.0 to 3.75 inches of available water to a depth of 5 feet. The organic-matter content of the surface layer ranges from 1 to 3.5 percent, and natural fertility is moderate. Roots are mostly in the surface layer above the very gravelly material, but some roots penetrate the very gravelly material.

Included in mapping were small areas of Millville silt loam, 2 to 4 percent slopes.

This Green Canyon soil is used for irrigated crops of alfalfa, small grain, and pasture. Where irrigation water is not available, the soil is used for dryland crops of alfalfa and winter wheat. A few acres are used for grazing. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Green Canyon gravelly loam, 0 to 3 percent slopes (GrA).—This soil occurs with Green Canyon gravelly loam, 3 to 7 percent slopes. Except for slope, it is similar to that soil. It is on the lower part of fans. Runoff is slow, and the hazard of erosion is slight.

Included in mapping were small areas of Millville silt loam, 2 to 4 percent slopes.

This Green Canyon soil is used mainly for irrigated crops of alfalfa, small grain, and pasture. A small acreage is in apple orchards. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Greenson Series

The Greenson series consists of somewhat poorly drained and moderately well drained soils that formed in mixed lake sediment and alluvium derived dominantly from limestone, sandstone, and quartzite. These nearly level to strongly sloping soils are on low lake terraces and fans at elevations of 4,450 to 4,650 feet. Slopes range from 0 to 10 percent. The vegetation is saltgrass, foxtail, alkali sacaton, Kentucky bluegrass, and some sedges and wiregrass. Average annual precipitation is 14 to 17 inches, and mean annual air temperature is 45° to 48° F. The frost-free season is 120 to 140 days. Greenson soils are associated with Collett, Nibley, Logan, Lewiston, and Roshe Springs soils.

In a representative profile (fig. 4), the surface layer is gray, mildly alkaline loam about 16 inches thick. The

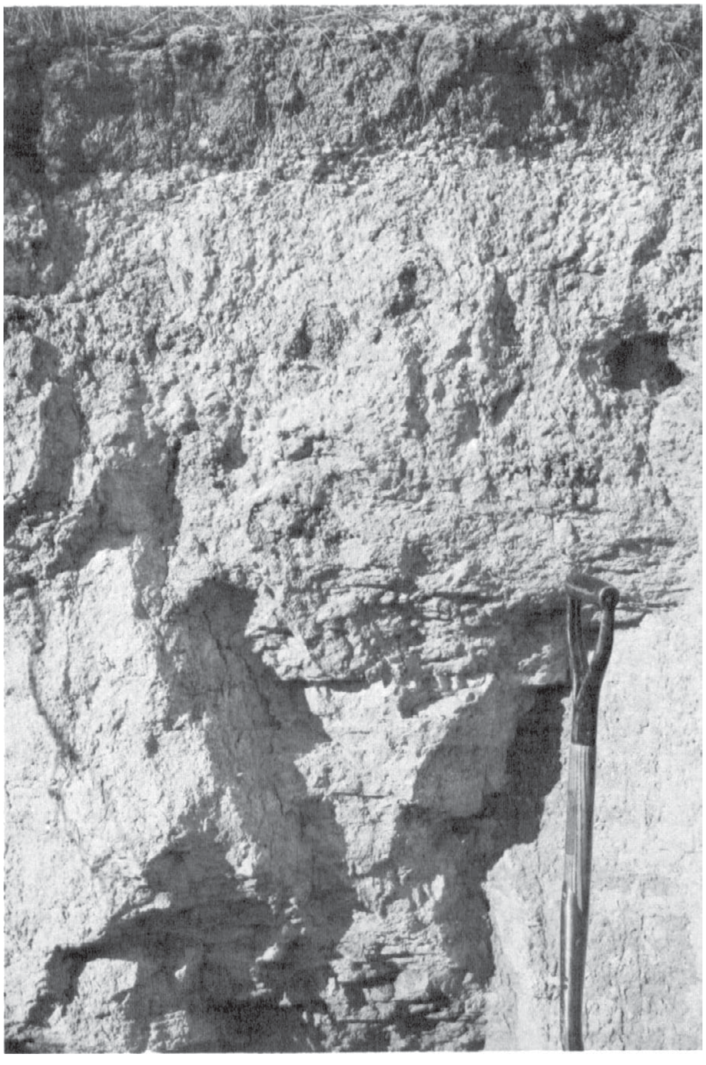

Figure 4.—Profile of Greenson loam, 0 to 3 percent slopes, showing the light-colored layer of lime accumulation that is near the surface of this soil.

subsoil is light brownish-gray, moderately alkaline loam about 7 inches thick. The substratum to a depth of 60 inches or more, is light-gray or very pale brown loam. Some carbonates have been leached from the surface layer and subsoil and redeposited in the substratum.

Greenson soils are used dominantly for irrigated crops of alfalfa, small grain, corn, sugar beets, and improved pasture. Some areas are used for range, and some are used for community and industrial development.

Greenson loam, 0 to 3 percent slopes (GsA).—This soil is on broad, smooth or slightly undulating, low lake terraces.

Representative profile in an irrigated area, 1 mile east and 1/4 mile north of Wellsville Cemetery, 1,320 feet south and 600 feet east of the northeast corner of sec. 36, T. 11 N., R. 1 W.:

Ap—0 to 7 inches, gray (10YR 5/2) loam, very dark gray (10YR 3/1) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common medium pores; slightly calcareous; mildly alkaline; clear, smooth boundary.

A1—7 to 16 inches, gray (10YR 5/1) loam, very dark gray (10YR 3/1) when moist; moderate, medium, granular structure that parts to moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common medium pores; slightly calcareous; mildly alkaline; clear, wavy boundary.

B2—16 to 23 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few medium pores; slightly calcareous, moderately alkaline; clear, wavy boundary.

C1ca—23 to 39 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; few, fine, faint, yellowish-brown (10YR 5/8) moist mottles; weak, very fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—39 to 51 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/6), moist mottles; massive; hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline; clear, wavy boundary.

C3—51 to 72 inches, very pale brown (10YR 8/3) loam, pale brown (10YR 6/3) when moist; common, medium, distinct, strong-brown (7.5YR 5/6), moist mottles; massive; hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline.

The A horizon ranges from gray to dark gray or dark grayish brown. Its texture is loam to silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is slightly calcareous. Thickness ranges from 12 to 19 inches. The B2 horizon ranges from light brownish gray to light gray or grayish brown in a hue of 10YR or 2.5Y. Texture is loam or silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is slightly calcareous to moderately calcareous. Thickness ranges from 4 to 13 inches. The C horizon ranges from light gray to white or pale olive in hues of 10YR or 5Y. Texture ranges generally from loam to silt loam or silty clay loam, but is gravelly loam in places. A horizon of lime accumulation occurs at a depth of 16 to 24 inches and is weakly cemented in places. Reaction is moderately alkaline to strongly alkaline. Faint to distinct, yellowish-brown or strong-brown mottles are at depths between 20 and 38 inches.

This soil is easy to till. Permeability is moderate. Runoff is slow, and the erosion hazard is none to slight. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Depth to the water table ranges from 30 to 60 inches. Much of the acreage is artificially drained. Roots extend to a depth of 5 feet where the soils are drained. In the undrained areas, most roots are above the water table.

Included in mapping were small areas of Collett silty clay loam and Logan silty clay loam.

This Greenson soil is used for irrigated crops of alfalfa, small grain, sugar beets, and pasture. (Capability unit IIw-2, irrigated; not in a range site or woodland suitability group; wildlife suitability group 1)

Greenson loam, 3 to 6 percent slopes (GsB).—This soil is similar to Greenson loam, 0 to 3 percent slopes, except that it is more sloping and its surface layer is 8 to 16 inches thick. This moderately well drained, moderately sloping soil generally is in small areas on terrace breaks. In a few places, the substratum is gravelly below a depth of 36 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Collett silty clay loam and small areas of Greenson loam, 6 to 10 percent slopes.

This soil is used mainly for irrigated crops of alfalfa, small grain, and improved pasture. A few small areas are used for native meadow pasture. (Capability unit IIw-2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Greenson loam, 6 to 10 percent slopes (GsC).—This soil commonly is in long, narrow bands on terrace breaks. It is similar to Greenson loam, 0 to 3 percent slopes, except that it is more strongly sloping and its surface layer is 8 to 12 inches thick. Wetness generally results from seeps along the upper areas of this soil. Surface runoff is medium, and the hazard of erosion is moderate.

Included in mapping were a few small areas of Nibley silty clay loam, 3 to 6 percent slopes, and a few small areas of soils that have a gravelly substratum.

This soil is used mostly for irrigated crops of alfalfa, small grain, and pasture. Some areas are used for native meadow pasture. (Capability unit IIIe-2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Greenson loam, deep over gravel, 0 to 1 percent slopes (GvA).—This soil is similar to Greenson silt loam, 0 to 3 percent slopes, except that the substratum is gravelly. Depth to gravelly loam material is below 36 inches. In places small amounts of gravel are scattered on the surface and throughout the profile. In an area of this soil south of the old Logan Sugar Factory, the gravel is strongly cemented at a depth below 3 feet. This makes drainage difficult and more costly. Runoff is slow, and the hazard of erosion is none to slight.

Included in mapping were small areas of Provo gravelly loam.

This Greenson soil is used mainly for irrigated crops of alfalfa, small grain, sugar beets, corn, and improved pasture. Small areas are used for native meadow hay and pasture. (Capability unit IIw-2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Greenson loam, deep over clay, 0 to 1 percent slopes (GuA).—This soil is similar to Greenson loam, 0 to 3 percent slopes, except that the substratum is silty clay or heavy silty clay loam that is slowly permeable. The soil is on low lake terraces adjacent to Collett, Logan, and Nibley soils. An area of this soil in the vicinity of the Utah State University Drainage and Reclamation Farm is moderately saline and alkali affected. This soil is somewhat poorly drained, and its permeability is slow, Runoff is slow, and the hazard of erosion is slight. Depth to the fine-textured underlying material ranges from 32 to 40 inches. The water table commonly is above the fine-textured material.

This soil is mostly used for irrigated crops of alfalfa, small grain, corn, sugar beets, and pasture. (Capability unit IIIw-25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Hendricks Series

The Hendricks series consists of well-drained soils that formed in noncalcareous alluvium derived from sandstone and quartzite. These soils are on old alluvial fans, slightly below or just above the highest lake terraces at elevations of 4,800 to 5,400 feet. Slopes range from 1 to 20 percent. The vegetation is big sagebrush, slender wheatgrass, cheatgrass, prairie junegrass, balsamroot, and yarrow. The average annual precipitation is 17 to 20 inches, the mean annual air temperature is 44° to 48° F., and the frost-free season is 120 to 140 days. Hendricks soils are associated with Nebeker, Hiibner, and Crowshaw soils.

In a representative profile, the surface layer is dark grayish-brown, neutral silt loam about 5 inches thick. The upper part of the subsoil is dark grayish-brown silt loam about 10 inches thick, and the lower part is brown to dark-brown or yellowish-brown, slightly acid silty clay loam to a depth of 60 inches or more.

Hendricks soils generally are used chiefly for dry cropland, but some areas are irrigated. Crops are small grain, alfalfa, silage corn, sugar beets, and pasture. Some small areas are used for range.

Hendricks silt loam, 6 to 10 percent slopes (HdC).—This soil is on gently undulating, old alluvial fans on or above the highest lake terraces. The soil extends along both eastern and western sides of Cache Valley.

Representative profile in a cultivated area, 1 mile south and 1¾ miles east of the old North Cache High School at Richmond, 900 feet east and 50 feet south of the northwest corner of the southeast quarter of sec. 1, T. 13 N., R. 1 E.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) silt loam; very dark brown (10YR 2/2) when moist; moderate, medium, granular structure that parts to moderate, fine, granular structure; slightly hard, friable, slightly sticky and plastic; common fine roots; common fine pores; neutral; abrupt, smooth boundary.

B1—5 to 15 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 22) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine roots; common fine and medium pores and few large pores; slightly acid; clear, smooth boundary.

B21t—15 to 27 inches, brown to dark-brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many fine pores and few medium pores; thin continuous clay films; slightly acid; clear, wavy boundary.

B22t—27 to 47 inches, yellowish-brown (10YR 5/4) silty clay loam, brown to dark brown (7.5YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine pores; thin continuous clay films; slightly acid; clear, smooth boundary.

B23t—48 to 66 inches, brown (7.5YR 5/4) silty clay loam, brown to dark brown (7.5YR 4/3) when moist; weak, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine pores and few medium pores; common thin clay films; slightly acid.

The A horizon ranges from dark grayish brown to grayish brown or to very dark grayish brown in a hue of 10YR. Texture ranges from silt loam or loam to very fine sandy loam. Thickness ranges from 5 to 12 inches. Some areas have a small amount of gravel and a few cobblestones scattered on the surface and throughout the profile. The B2t horizon ranges from silty clay loam to clay loam. Reaction is neutral to slightly acid.

The soil is easy to till. Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots extend to a depth of 5 feet or more.

Included in mapping were small areas of Crowshaw gravelly loam, 6 to 10 percent slopes, and small areas of recent stony alluvium.

This soil is used mainly for dryland crops of alfalfa and small grain. Some areas are irrigated. (Capability unit IIIe-2, irrigated, IIIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Hendricks silt loam, 1 to 3 percent slopes (HdA).—This soil is on the lower part of alluvial fans. Except for slope, it is similar to Hendricks silt loam, 6 to 10 percent slopes. Runoff is slow, and the hazard of erosion is slight.

Included in mapping were small areas of Ricks gravelly loam, 0 to 3 percent slopes, and a few small areas of a soil that has slopes of 3 to 6 percent.

About 60 percent of the acreage of this Hendricks soil is irrigated. Crops are alfalfa, small grain, corn for silage, and sugar beets. Nearly 40 percent is used for dryland crops of alfalfa and small grain. A few areas are used for range. (Capability unit IIc-2, irrigated, IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Hendricks silt loam, 3 to 6 percent slopes (HdB).—This is a gently undulating soil on old alluvial fans. It is similar to Hendricks silt loam, 6 to 10 percent slopes, except that it is less sloping and its surface layer is about 7 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is easy to work, has good tilth, and can be cultivated within a wide range of moisture content.

Included in mapping were small areas of Ricks gravelly loam, 3 to 6 percent slopes.

About 70 percent of the acreage of this Hendricks soil is irrigated, and 30 percent is dryfarmed. Alfalfa and small grain are the principal crops. (Capability unit IIe-2, irrigated; IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Hendricks silt loam, 10 to 20 percent slopes (HdD).—This soil is on alluvial fans with other Hendricks soils. Except for slope, it is similar to Hendricks silt loam, 6 to 10 percent slopes. The subsoil ranges from silty clay loam to heavy silt loam in the upper part and is silty loam in the lower part. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Included in mapping were small areas of Sterling gravelly loam, 10 to 20 percent slopes, and a few small areas of a soil that has slopes of slightly more than 20 percent.

This Hendricks soil is used mostly for dryland crops of small grain and alfalfa. Some areas are used for range. (Capability unit IVe-2, irrigated, IVe-M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hiibner Series

The Hiibner series consists of well-drained soils that formed in colluvium and alluvium derived from sandstone and quartzite. These soils are on alluvial fans and on dissected slopes of mountains. The elevation ranges from 4,500 to 6,000 feet, and slopes range from 1 to 30 percent. The average annual precipitation is 17 to 20 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 100 to 140 days. Hiibner soils are associated with Nebeker, Parleys, Hendricks, and Crowshaw soils.

In a representative profile, the surface layer is very dark grayish-brown and dark grayish-brown, neutral extremely stony gravelly clay loam about 6 inches thick. The subsoil is reddish-brown, slightly acid very cobbly clay that extends to a depth of 60 inches or more.

Hiibner soils are used chiefly for range. Some small areas are used for dryland crops of alfalfa and small grain.

Hiibner extremely stony clay loam, 1 to 30 percent slopes (HfE).—This soil is on alluvial fans and mountain foot slopes, mainly near the town of Mendon and east of Paradise.

Representative profile, about 1 mile west of Mendon, 30 feet west and 20 feet north of the northeast corner of sec. 1, T. 11 N., R. 2 W.:

A11—0 to 3 inches, very dark grayish-brown (10YR 3/2) extremely stony clay loam, very dark brown (10YR 2/2) when moist; weak, fine, platy structure that parts to weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; medium fine pores; about 25 percent gravel and cobblestones and 5 percent stones; neutral; clear, wavy boundary.

A12—3 to 6 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots and few medium roots; many fine and large pores; about 25 percent gravel and cobblestones and 5 percent stones; neutral; clear, wavy boundary.

B21t—6 to 12 inches, brown to dark-brown (7.5YR 4/2) very cobbly clay, dark brown (7.5YR 3/2) when moist; strong, medium, prismatic structure that parts to moderate, fine, angular blocky structure; extremely hard, extremely firm, sticky and plastic; common medium roots; common fine and medium pores; 40 percent gravel and cobblestones and 10 percent stones; common moderately thick clay films; slightly acid; gradual, wavy boundary.

B22t—12 to 27 inches, reddish-brown (5YR 5/4) very cobbly clay, reddish brown (5YR 4/4) when moist; strong, coarse, prismatic structure that breaks to moderate, fine, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; common fine and medium roots; common fine pores; common thick clay films; 50 percent cobblestones and gravel and 10 percent stones; slightly acid; gradual, wavy boundary.

B23t—27 to 60 inches, reddish-brown (5YR 5/4) very cobbly clay, reddish brown (5YR 4/4) when moist; strong, coarse, prismatic structure that breaks to moderate, fine, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine and medium roots; few fine and medium pores; common thick clay firms; 70 percent cobblestones and gravel and 10 percent stones; slightly acid.

The A1 horizon ranges from very dark grayish brown to dark grayish brown or to brown in a hue of 10YR or 7.5YR. Texture ranges from gravelly loam to gravelly clay loam or extremely stony clay loam. Reaction is neutral to slightly acid. Thickness ranges from 5 to 12 inches. The B2t horizon ranges from reddish brown to brown or dark brown to yellowish brown in hues of 10YR to 5YR. Texture ranges from very cobbly clay to extremely stony heavy clay loam. The B2t horizon is 40 to 70 percent gravel and cobblestones and about 10 percent stones. Reaction ranges from slightly acid to mildly alkaline.

Permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 5 to 7 inches of available water to a depth of 5 feet. Roots extend to a depth of 4 feet or more.

Included in mapping were small areas of Nebeker silt loam, 10 to 25 percent slopes, and small areas of Hiibner gravelly clay loam, 20 to 30 percent slopes.

This soil is used for range that is grazed after crops are harvested from adjacent fields. (Capability unit VIIs-MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Hiibner gravelly clay loam, 3 to 10 percent slopes (HeC).—This soil is on mountain foot slopes and high terraces. It is similar to Hiibner extremely stony clay loam, 1 to 30 percent slopes, except that the surface layer is gravelly clay loam 8 to 12 inches thick and is slightly eroded. Runoff is slow to medium, and the erosion hazard is slight to moderate.

Included in mapping were small areas of a soil that has 1 to 3 percent slopes, and small areas of Nebeker silt loam, 6 to 10 percent slopes.

This Hiibner soil is used mainly for range that is grazed after the crops from adjacent cropland have been harvested. Some areas are used for dryland small grain crops. (Capability unit IIIe-MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Hiibner gravelly clay loam, 10 to 20 percent slopes (HeD).—This soil is in long, narrow tracts on mountain foot slopes and high lake terrace escarpments. It is similar to Hiibner extremely stony clay loam, 1 to 30 percent slopes, except that the surface layer is gravelly clay loam 9 to 12 inches thick and is slightly eroded. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Nebeker silt loam, 10 to 25 percent slopes, and small areas of a soil that has slightly steeper slopes.

This Hiibner soil is used for range that is grazed after the crops on adjacent cropland areas have been harvested. (Capability unit IVe-MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Hiibner gravelly clay loam, 20 to 30 percent slopes (HeE).—This soil is in long, narrow tracts on mountain foot slopes and high lake terrace escarpments. It is similar to Hiibner extremely stony clay loam, 1 to 30 percent slopes, except that the surface layer is gravelly clay loam 7 to 12 inches thick and is slightly eroded. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Included in mapping were small areas of Nebeker silt loam, 10 to 25 percent slopes, and small areas of a soil that has slightly steeper slopes.

This Hiibner soil is used for rangeland, watershed, and wildlife habitat. (Capability unit VIe–MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Hillfield Series

The Hillfield series consists of well-drained soils that formed in mixed lake sediment derived mainly from limestone, sandstone, and quartzite. These soils are on terrace escarpments and rolling terraces along the eastern side of Cache Valley. The elevation ranges from 4,800 to 5,100 feet. Slopes range from 10 to 30 percent. The vegetation is western wheatgrass, cheatgrass, bluebunch wheatgrass, yarrow, and big sagebrush. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 130 to 150 days. Hillfield soils are associated with Parleys, Timpanogos, McMurdie, and Ricks soils.

In a representative profile, the surface layer is brown, mildly alkaline silt loam about 8 inches thick. This is underlain by mildly alkaline, light yellowish-brown silt loam, very pale brown and light yellowish-brown loam, and light yellowish-brown very fine sandy loam that extends to a depth of 60 inches or more. The soil is strongly calcareous throughout. Some carbonates have leached from the upper part of the soil and redeposited, at a depth of 7 to 12 inches, to form a lime horizon.

Hillfield soils are used mostly for dryland crops of alfalfa and small grain.

Hillfield silt loam, 20 to 30 percent slopes, eroded (HgE2).—This soil is on high lake terrace escarpments along the eastern side of Cache Valley. It is rolling or hilly and has short slopes that generally face west. The soil is moderately eroded.

Representative profile in a cultivated area, 2 miles north and ½ mile east of Paradise, 400 feet south and 600 feet east of the northeast corner of the southeast quarter of sec. 15, R. 10 N., R. 1 E.:

Ap—0 to 8 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; common fine pores; strongly calcareous, mildly alkaline; abrupt, smooth boundary.

C1ca—8 to 15 inches, light yellowish-brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; common fine pores and few medium pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C2ca—15 to 23 inches, very pale brown (10YR 7/4) loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; common fine pores; strongly calcareous; mildly alkaline; clear, wavy boundary.

C3—23 to 40 inches, light yellowish-brown (10YR 6/4) loam, brown (10YR 5/3) when moist; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many fine and few medium pores; strongly calcareous; mildly alkaline.

C4—40 to 60 inches, light yellowish-brown (10YR 6/4) very fine sandy loam, brown (10YR 5/3) when moist; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; single grain; soft, very friable, nonsticky and nonplastic; strongly calcareous; mildly alkaline.

The A horizon ranges from brown to pale brown or grayish brown. Thickness ranges from 7 to 9 inches. Texture is dominantly silt loam but ranges to loam, very fine sandy loam, or light silty clay loam. The Cca and C horizons range from very pale brown to light yellowish brown or light brownish gray. These horizons are stratified and range from loamy to loamy fine sand or to silty clay loam. The calcium carbonate equivalent in the Cca horizon ranges from 20 to 40 percent. Reaction is mildly alkaline to moderately alkaline.

This soil is easy to till. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. This soil holds 8 to 10 inches of available water to a depth of 5 feet. Roots extend to a depth of 4 feet or more.

Included in mapping were small areas of Parleys silt loam, 6 to 10 percent slopes, and a few small areas of a Hillfield soil that has slopes of 10 to 20 percent.

This soil is used mostly for range but provides only limited grazing. Some of the acreage is used for dryland crops of alfalfa and small grain. (Capability unit VIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Hillfield-Timpanogos silt loams, 10 to 30 percent slopes, eroded (HhE2).—This complex consists of rolling to moderately steep soils on high lake terraces on the eastern side of Cache Valley. Runoff is medium to rapid, and the hazard of erosion is moderate to high. About 60 percent of the association is Hillfield silt loam, 20 to 30 percent slopes, eroded, and about 40 percent is Timpanogos silt loam, 10 to 20 percent slopes, eroded.

The Hillfield soil is steeper than the Timpanogos soil and has slopes that face south and west. In places its surface layer is very fine sandy loam.

The more gently sloping Timpanogos soil has a northerly exposure. It is similar to Timpanogos silt loam, 0 to 3 percent slopes, except that it is more sloping and its surface layer is 7 to 9 inches thick. The soil is moderately eroded, and in places the subsoil has been exposed by tillage.

Included in mapping were small areas of Parleys silt loam, 6 to 10 percent slopes.

The soils of this complex are used for dryfarming and interspersed areas of range. Winter wheat and alfalfa are the principal crops. (Capability unit VIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Hoskin Series

The Hoskin series consists of somewhat excessively drained soils that formed in residuum and colluvium derived from the Wasatch conglomerate and sandstone. Bedrock is at a depth of 24 to 40 inches. These soils are on dominantly south- and west-facing mountain slopes at elevations of 6,000 to 8,000 feet. Slopes range from 1 to 70 percent. The vegetation is big sagebrush, bluebunch wheatgrass, Great Basin wildrye, bitterbrush, yellowbrush, cheatgrass, serviceberry, and balsamroot. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 40° to 45° F., and the frost-free season is 70 to 90 days. Hoskin soils are associated with Ant Flat, Scave, Lucky Star, Agassiz, and Scout soils.

In a representative profile, the surface soil is brown to dark-brown, neutral cobbly loam about 7 inches thick. The subsoil is brown, neutral very cobbly loam about 9 inches thick. The substratum is brown, neutral very cobbly loam about 12 inches thick. Bedrock is at a depth of about 28 inches. Between the depths of 7 and 20 inches, the soil is continuously dry for a period of 50 days or more in summer.

Hoskin soils are used for range, wildlife habitat, and watershed.

Hoskin cobbly loam, 30 to 70 percent slopes, eroded (HKG2).—This soil is on west- and south-facing slopes of mountains. It is mostly in the area south of Hardware Ranch near the Sheep Creek and Mill Creek drainages. Small areas are in the Cinnamon Creek area south of Mineral Point. Other areas are scattered throughout the mountains.

Representative profile, 100 feet west and 100 feet south of the northeast corner of sec. 21, T. 9 N., R. 3 E., 6½ miles south and 1 mile west of Hardware Ranch:

A1—0 to 7 inches, brown to dark-brown (7.5YR 4/3) cobbly loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine, medium, and large roots; 40 percent gravel and cobblestones; neutral; clear, wavy boundary.

B2t—7 to 16 inches, brown (7.5YR 5/4) very cobbly loam, dark brown (7.5YR 3/4) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many fine and medium roots; many fine pores; common thin clay films; 60 percent gravel and cobblestones; neutral; gradual, wavy boundary.

C—16 to 28 inches, brown (7.5YR 5/4) very cobbly loam; brown to reddish brown (5YR 4/4) when moist; massive; soft, friable, nonsticky and slightly plastic; few fine and medium roots; many fine pores; soil matrix is noncalcareous, lime on underside of coarse fragments; 80 percent cobblestones and stones; neutral.

R—28 inches, consolidated conglomerate.

The combined thickness of the A1, B1, and B2t horizons ranges from 14 to 30 inches. Coarse fragments are mainly cobblestones and gravel-size, rounded or slightly angular fragments of quartzite or sandstone. Their content ranges from 20 to 50 percent in the A1 and B1 horizons and from 50 to 80 percent in the B2t and C horizons. The A1 horizon ranges from brown to dark brown or reddish brown in a hue of 7.5YR or 5YR. Reaction is neutral to slightly acid. Thickness ranges from 5 to 12 inches. In the Cinnamon Creek area, this soil is only slightly eroded and the surface layer ranges from 12 to 15 inches in thickness. The B2t horizon ranges from brown to reddish brown or strong brown in a hue of 7.5YR or 5YR. Texture ranges from very cobbly sandy clay loam to very cobbly loam. Reaction ranges from neutral to medium acid. Thickness ranges from 8 to 15 inches. The C horizon ranges from brown or reddish brown to yellowish brown or light reddish brown in a hue of 7.5 YR, 5YR, or 10YR. Texture ranges from very cobbly loam or stony loam to very cobbly sandy loam. Reaction is neutral to mildly alkaline.

Permeability is moderately rapid. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 3.5 to 4.0 inches of available water above the bedrock. Roots penetrate to the bedrock.

Included in mapping were small areas of Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded.

This Hoskin soil is used for range, wildlife habitat, and watershed. (Capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hoskin-Datwyler association, eroded (30 to 70 percent slopes) (HLG2).—This mapping unit consists of soils on Murrays Hill at the south end of the Wellsville Mountain. These soils generally are on the broad ridges and upper side slopes adjacent to the ridges, which have south and east aspects. They are at elevations of 5,500 to 6,500 feet. About 50 percent of the association is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 30 percent Datwyler cobbly silty clay loam, 30 to 60 percent slopes; and 20 percent included soils.

The Hoskin soil is dominant on the landscape and is intermingled with outcrops of limestone and limy sandstone, as well as ledges and talus slopes. This soil is similar to Hoskin cobbly loam, 30 to 70 percent slopes, eroded. It has a cover of grasses and shrubs.

The Datwyler soil has open, south-facing slopes and is in slightly more concave positions than the Hoskin soil. It is similar to Datwyler cobbly silty clay loam, 30 to 60 percent slopes, which is described under the Datwyler series.

Included in mapping were areas of rock outcrop, areas of Smarts gravelly silt loam, 30 to 70 percent slopes, and areas of Elzinga silt loam, 30 to 60 percent slopes. The Smarts and Elzinga soils are on the lower slopes and in depressions, and the vegetation is maple. The rock outcrop makes up 10 percent of the total acreage in the association, and Smarts and Elzinga soils each make up 5 percent.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hoskin-Elzinga association, eroded (30 to 70 percent slopes) (HMG2).—This mapping unit consists of soils on slopes of mountains south of Mineral Point. The landscape is characterized by parallel ridges of varying parent rock. About 40 percent of the association is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 35 percent is Elzinga silt loam, 30 to 60 percent slopes; 20 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and about 5 percent is included soils.

The Hoskin and Agassiz soils are on the slightly convex ridgetops and side slopes that have south and west aspects. The vegetation is mostly big sagebrush, bunchgrasses, and forbs on the Hoskin soil and mountain-mahogany, snowberry, bitterbrush, and ceanothus on the Agassiz soil.

The Elzinga soil has slightly concave, mainly north-facing slopes. The vegetation is maple and a sparse understory of chokecherry, wheatgrass, and false Solomons-seal.

Included in mapping were areas of Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Hoskin soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Elzinga soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hoskin-Scave association (6 to 70 percent slopes) (HNG).—This mapping unit consists of soils that are mainly south of Hardware Ranch in the Mill Creek area. These soils are on slopes of mountains. About 50 percent of the association is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 30 percent is Scave silt loam, 10 to 30 percent slopes; and 20 percent is Ant Flat loam, 6 to 20 percent slopes.

The Hoskin soil has south-facing slopes, where the vegetation is perennial grasses and shrubs. The Scave soil has north-facing slopes, where the vegetation is aspen. The Ant Flat soil is on broad ridgetops and at the heads of draws, where the vegetation is perennial grasses and shrubs.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Hoskin soil is capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Scave soil is in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Ant Flat soil is in capability unit VIe–M, non-irrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hoskin-Scout association, eroded (30 to 70 percent slopes) (HOG2).—This mapping unit consists of steep and very steep soils on James Peak in the southern part of Cache County. About 60 percent of the association is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 25 percent is Scout gravelly loam, 40 to 70 percent slopes; 5 percent is rubble land and rock outcrop; and 10 percent is minor soils.

The Hoskin soil has open slopes that face west, south, and east. This soil is similar to Hoskin cobbly loam, 30 to 70 percent slopes, except that its slopes are dominantly 30 to 60 percent. Its plant cover is big sagebrush and bunchgrasses. The Scout soil has slopes that mostly face north. It is similar to Scout gravelly loam, 40 to 70 percent slopes, except that 1 to 2 percent of its surface is covered with scattered stones. Its plant cover is Douglas-fir and alpine fir. Rock outcrop and rubble land are near the mountain, and they support little vegetation.

Included in mapping were areas of Yeates Hollow soil at the mouths of small canyons on alluvial fans.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. Trees have been harvested from areas of the Scout soil. (Hoskin soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3. Scout soil is in capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Hoskin-Smarts association, eroded (30 to 70 percent slopes) (HSG2).—This mapping unit is on the lower east side and upper west side of Wellsville Mountain. About 60 percent of it is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; 25 percent is Smarts gravelly silt loam, 30 to 70 percent slopes; and 15 percent is rock outcrop and rock land.

The Hoskin soil is on the lower slopes of uniformly steep, somewhat dissected, south- and west-facing dip scarp slopes. It is similar to Hoskin cobbly loam, 30 to 70 percent slopes, except that its slopes are dominantly 60 to 70 percent and its surface layer is cobbly loam to gravelly loam.

The Smarts soil is in steep drainageways and near the bottom of slopes. It is similar to Smarts silt loam, 10 to 30 percent slopes, except that it is steeper and its surface layer is 20 to 30 percent gravel and is 15 to 25 inches thick.

Rock outcrop and rock land are in the form of ledges and rockslides on talus slopes.

Soils of this mapping unit are used for watershed and wildlife habitat. (Hoskin soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Smarts soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. Neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

Hoskin gravelly loam, thick surface, 1 to 6 percent slopes (HIB).—This soil is on the alluvial valley bottom of Strawberry Valley and in small areas adjacent to streams. It is somewhat less gravelly and cobbly in the subsoil than other Hoskin soils, and it has more gentle slopes.

This soil is moderately well drained, and its permeability is moderate. Runoff is slow, and the erosion hazard is slight. This soil holds 5.0 to 7.0 inches of available water to a depth of 5 feet. The water table is between depths of 40 and 60 inches late in spring and early in summer for 30 to 60 days following snowmelt. Roots penetrate to a depth of 4 feet or more but are mostly above the very gravelly material.

This soil is used for range and wildlife habitat. (Capability unit VIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Hyrum Series

The Hyrum series consists of well-drained, very cobbly soils. These soils formed in alluvium and modified lake sediment derived mainly from sandstone and quartzite and, to a lesser extent, from limestone rocks. They are on high and intermediate lake terraces at elevations of 4,600 to 5,000 feet. Slopes range from 4 to 25 percent. The vegetation is big sagebrush, slender wheatgrass, western wheatgrass, and bluebunch wheatgrass. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 130 to 150 days. Hyrum soils are associated with Crowshaw, Hendricks, Hiibner, Nebeker, Mendon, and Ricks soils.

In representative profile, the surface layer is very dark grayish-brown, neutral gravelly loam about 8 inches thick. The subsoil is very dark grayish brown, dark grayish-brown, and grayish-brown, neutral very cobbly clay loam about 36 inches thick. The substratum is pale-brown, mildly alkaline very cobbly loam to a depth of 60 inches or more.

Hyrum soils are used for dryfarmed crops and for range.

Hyrum gravelly loam, 10 to 25 percent slopes (HuE).—This soil is on intermediate and high terraces, chiefly in an area west and south of the town of Mendon. Slopes are generally short and undulating.

Representative profile, one-half mile west of Mendon, 400 feet south and 900 feet west of the northeast corner of sec. 7, T. 11 N., R. 1 W.:

A1—0 to 8 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, granular structure; hard, friable, slightly sticky and plastic; many fine roots; many fine pores; neutral; clear, smooth boundary.

B1—8 to 17 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure that parts to moderate, fine, granular structure; hard, friable, sticky and plastic; few thin clay films; common fine roots; many fine, medium, and large pores; neutral; diffuse, smooth boundary.

B21t—17 to 31 inches, dark grayish-brown (10YR 4/2) very cobbly clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure that parts to moderate, fine, subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; many fine and medium pores; thin continuous clay films on peds; neutral; clear, smooth boundary.

B22t—31 to 42 inches, grayish-brown (10YR 5/2) very cobbly clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few fine roots; many medium and fine pores; few thin clay films on some peds; neutral.

C—42 to 60 inches, pale-brown (10YR 6/3) very cobbly loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline.

The combined thickness of the A and B horizons ranges from 30 to 45 inches. Coarse fragments are mostly cobblestone- and gravel-sized, slightly rounded and angular fragments of sandstone and quartzite rock but include fragments of limestone in places. The amount of coarse fragments ranges from 20 to 40 percent, by volume, in the A1 horizon and from 50 to 80 percent in the B and C horizons. The A1 horizon ranges from very dark grayish brown to grayish brown. Thickness ranges from 7 to 8 inches. The B2t horizon ranges from dark grayish-brown to brown. Texture ranges from very cobbly clay loam to very cobbly heavy loam. The C horizon ranges from pale brown to brown or light grayish brown. Texture ranges from very cobbly loam to very cobbly heavy very fine sandy loam. Reaction is mildly alkaline to neutral. In places, calcareous lake sediments are present at depths below 36 inches.

This soil is somewhat difficult to till. Permeability is moderate. Runoff is medium, and the erosion hazard is moderate. This soil holds 5 to 7 inches of water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more.

Included in mapping were small areas of Crowshaw gravelly loam, 3 to 6 percent slopes.

This soil is used mostly for dryfarmed crops of alfalfa or alfalfa and grass mixtures and winter wheat. Some areas are used for range. (Capability unit IVe–UX, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Hyrum gravelly loam, 4 to 8 percent slopes (HuC).—This soil is mostly on medium lake terraces at the south end of Newton Hill. It is similar to Hyrum gravelly loam, 10 to 25 percent slopes, except that it is less sloping and its surface layer is 8 to 10 inches thick. Runoff is slow, and the hazard of erosion is slight.

Included in mapping were small areas of soils that have a cobbly surface layer and small areas of Hendricks silt loam, 3 to 6 percent slopes.

This Hyrum soil is used for dryfarmed crops of winter wheat and alfalfa. (Capability unit IIIe–UX, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Hyrum cobbly loam, 4 to 8 percent slopes (HyC).—This soil is mainly in an area about a mile northeast of Newton. It is similar to Hyrum gravelly loam, 10 to 25 percent slopes, except that it is less sloping and its surface layer is about 30 percent cobblestones. The cobblestones are mostly semirounded quartzite. Runoff is slow, and the erosion hazard is slight.

Included in mapping were small areas of shallow gravelly soils.

This Hyrum soil is used mostly for dryfarmed crops of wheat. In places some of the larger cobblestones have been removed from the surface. (Capability unit IIIe–UX, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Jordan Series

The Jordan series consists of somewhat poorly drained soils that are affected by salt and alkali. These soils formed in mixed lake sediment derived mainly from limestone, sandstone, and shale. They are on low lake terraces near the valley bottom at elevations of 4,400 to 4,500 feet. Slopes are 0 to 1 percent. The vegetation is saltgrass, alkali sacaton, foxtail, peppergrass, and greasewood. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Jordan soils are associated with Lasil, Airport, Payson, Trenton, and Quinney soils.

In a representative profile, the surface layer is light brownish-gray, moderately alkaline silty clay loam about 5 inches thick. The subsoil is brown and pale-brown, moderately alkaline and strongly alkaline silty clay about 16 inches thick. The substratum is pinkish-gray to very pale-brown silty clay or silty clay loam to a depth of 60 inches or more.

Jordan soils are used mostly for range.

Jordan-Lasil silty clay loams (Jr).—This complex consists of soils on low lake terraces, mostly about 4 miles west of Smithfield. About 60 percent of the complex is Jordan silty clay loam, and 40 percent is Lasil silty clay loam. These soils are in areas made up of depressions and mounds. The Jordan soil is in the depressions, and the Lasil soil is on mounds that are 1 to 2 feet higher in elevation.

The Lasil soil is described under the Lasil series.

Representative profile of Jordan silty clay loam, in an area of Jordan-Lasil complex, ½ mile north and ¾ mile west of Amalga Church, 800 feet south and 1,300 feet east of the northwest corner of sec. 24, T. 13 N., R. 1 W.:

Ap—0 to 5 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish-brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure mixed with weak, fine and medium, granular structure; hard, friable, sticky and plastic; common fine roots; common fine pores; slightly calcareous; moderately alkaline; abrupt, smooth boundary.

B21t—5 to 10 inches, brown (7.5YR 5/2) silty clay, dark brown to brown (7.5YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots; many fine pores; thin continuous clay films; moderately calcareous; moderately alkaline; clear, wavy boundary.

B22tcasa—10 to 21 inches, pale-brown (10YR 6/3) silty clay, brown (7.5YR 5/4) when moist; moderate, coarse, prismatic structure breaking to moderate, coarse, subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots; many fine pores; thin continuous clay films; strongly calcareous; strongly alkaline; clear, smooth boundary.

C1—21 to 42 inches, very pale brown (10YR 7/3) silty clay loam, brown (7.5YR 5/3) when moist; common, medium, distinct, yellowish-red (5YR 5/6) mottles; massive; very hard, very firm, very sticky and very plastic; common fine pores; strongly calcareous; strongly alkaline.

C2—42 to 60 inches, pinkish-gray (7.5YR 7/2) silty clay, brown (7.5YR 5/3) when moist; common, medium, distinct, yellowish-red (5YR 5/6) mottles; massive; very hard, very firm, very sticky and very plastic; common fine pores; strongly calcareous; strongly alkaline.

The A horizon ranges from pale brown to light brownish gray in hues of 10YR and 7.5YR. The B2t horizon ranges from brown to light brown. Texture is dominantly silty clay but ranges to heavy silty clay loam. The outside of peds is noncalcareous, but peds are moderately or strongly calcareous when crushed. A horizon of carbonate accumulation begins in the lower part of the B horizon and extends into the C horizon in places. Calcium carbonate equivalent in the ca horizon ranges from 15 to 35 percent.

The C horizon ranges from very pale brown to brown in hues of 7.5YR and 10YR. The exchangeable sodium percentage ranges from 13 to 26 in the A horizon, from 30 to 90 in the B2t horizon, and from 45 to 80 in the C horizon. The soluble salt content ranges from 0.2 to 2.2 percent, and the highest concentration generally is in the lower part of the B2t horizon. Common, distinct mottles are at depths of 20 to 36 inches. The water table varies with the season, but it generally is at depths between 30 and 48 inches.

Permeability is slow to very slow. Runoff is slow, and the hazard of erosion is none to slight. This soil holds 7.5 to 9.0 inches of water to a depth of 5 feet, and only about 2 inches is available to plants because of the salt. Most roots are in the surface layer 10 to 13 inches above the strong concentrations of alkali and salt.

Included in mapping were small areas of Cache silty clay.

Soils of this mapping unit are used chiefly for range. (Capability unit VIIw–285, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Jordan silty clay loam (Jo).—This soil is on the broad, slightly concave, low lake terraces in the central part of Cache Valley.

Included in mapping were small areas of soils that have a silt loam surface layer and small areas of soils that have slopes of 1 to 3 percent. Also included were a few small areas of Cache silty clay.

This Jordan soil is mostly used for range. It is better suited to that purpose than to use for crops that require cultivation, but some small areas are cultivated. (Capability unit VIIw–285, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Kidman Series

The Kidman series consists of moderately well drained and well drained soils that formed in mixed lake sediment derived mainly from limestone and sandstone. These soils are on smooth to slightly undulating, medium lake terraces at elevations of 4,450 to 4,550 feet. Slopes range from 0 to 15 percent. The vegetation consists of big sagebrush, bluebunch wheatgrass, cheatgrass, and gumweed. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 130 to 150 days. Kidman soils are associated with Lewiston, Timpanogos, and Layton soils.

In a representative profile, the surface layer is brown, mildly alkaline fine sandy loam about 8 inches thick. The subsoil is brown, mildly alkaline fine sandy loam about 12 inches thick. The substratum, to a depth of 60 inches or more, is brown and pale-brown moderately alkaline fine sandy loam and sand.

Kidman soils are used for irrigated crops.

Kidman fine sandy loam, deep water table, 0 to 2 percent slopes (KfA).—This soil is on lake terraces at medium elevations in the central part of Cache Valley.

Representative profile in a cultivated area, 3 miles west and 1¾ miles south of Lewiston, 1,200 feet north and 200 feet east of the southwest corner of sec. 13, T. 14 N., R. 1 W.:

Ap—0 to 8 inches, brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure and weak, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots and few large roots; few large pores; noncalcareous; mildly alkaline; abrupt, smooth boundary.

B1—8 to 12 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots and few large roots; few fine, medium, and large pores; noncalcareous; mildly alkaline; clear, smooth boundary.

B2—12 to 20 inches, brown (7.5YR 5/3) fine sandy loam, dark brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; common fine and medium pores; few thin clay films; noncalcareous; mildly alkaline; gradual, wavy boundary.

C1—20 to 27 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 3/4) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; common fine roots and few medium roots; common fine pores; noncalcareous; mildly alkaline; clear, wavy boundary.

C2ca—27 to 43 inches, brown (7.5YR 5/4) fine sandy loam, dry and moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; few fine pores; moderately calcareous; moderately alkaline; clear, wavy boundary.

IIC3—43 to 60 inches, pale-brown (10YR 6/3) fine sand, yellowish brown (10YR 5/4) when moist; single grain; loose, nonsticky and nonplastic; few fine roots; moderately calcareous; moderately alkaline.

The A horizon ranges from brown to dark brown or dark grayish brown. Texture ranges from fine sandy loam to very fine sandy loam or light loam. Reaction is mildly alkaline to neutral. Thickness ranges from 8 to 20 inches. The B2 horizon ranges from brown to pale brown or light brown. Texture ranges from fine sandy loam to light loam. The Cca and C horizons range from brown or pale brown to very pale brown or light yellowish brown. Texture ranges from fine sandy loam to fine sand. Reaction is moderately alkaline to strongly alkaline. The depth to the water table ranges from 40 to more than 60 inches. Distinct mottles occur at depths below 32 inches in places.

This soil is easy to work and absorbs water readily. It is moderately well drained and has moderately rapid permeability. Runoff is slow, and the hazard of water erosion is slight, but the hazard of soil blowing is moderate. This soil holds 7.5 to 8.0 inches of available water to a depth of 5 feet. Roots penetrate the soil easily to a depth of 5 feet or more.

This soil is mostly used for irrigated crops of alfalfa, sugar beets, small grain, and corn for silage and improved pasture. (Capability unit IIc-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kidman fine sandy loam, 0 to 2 percent slopes (KdA).—This level or slightly undulating soil is on broad, intermediate lake terraces in the north-central part of Cache Valley. It is similar to Kidman fine sandy loam, deep water table, 0 to 2 percent slopes, except that it is well drained. This soil is on slightly higher areas or areas adjacent to the Bear River. The water table and mottles are at a depth of more than 60 inches. The depth to the horizon of accumulated lime is commonly more than 30 inches.

Included in mapping were small areas of Preston fine sand and a few small areas of moderately well drained Kidman soils.

This soil has moderate permeability. It holds 7.5 to 8.0 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet or more.

This soil is used for irrigated crops of alfalfa, sugar beets, small grain, corn for silage, and pasture. The principal management need is the control of erosion. (Capability unit IIc-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kidman fine sandy loam, deep water table, 2 to 4 percent slopes (KfB).—This soil is on medium lake terraces, mostly in the north-central part of Cache Valley. The surface layer ranges from 10 to 16 inches in thickness.

Included in mapping were small areas of Layton loamy fine sand and small areas of well-drained Kidman soils.

This soil is used for irrigated crops and improved pasture. The main crops are alfalfa, sugar beets, small grain, and corn for silage. (Capability unit IIe-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kidman fine sandy loam, deep water table, 4 to 8 percent slopes (KfC).—This gently undulating soil is on lake terraces, mainly in small areas in the north-central part of Cache Valley. The surface layer is 8 to 12 inches thick. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Layton loamy fine sand. Also included were areas of soils that have a very fine sandy loam surface layer and a few small areas of soils that have slopes of slightly more than 8 percent.

This soil is used mainly for irrigated crops of alfalfa and small grain and for pasture. (Capability unit IIIe-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kidman fine sandy loam, 8 to 15 percent slopes (KdD).—This soil is in relatively small, widely separated tracts on terrace breaks, mainly in association with other Kidman soils. It is similar to Kidman fine sandy loam, deep water table, 0 to 2 percent slopes, except that it is more sloping, it is well drained, and the water table is below a depth of 60 inches. The surface layer is 7 to 12 inches thick. Runoff is medium, and the hazard of erosion is moderate.

The soil is used for irrigated crops and pasture. Alfalfa and small grain are the principal crops. (Capability unit IVe-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Kirkham Series

The Kirkham series consists of somewhat poorly drained soils that formed in stratified, calcareous alluvium derived from limestone, sandstone, and quartzite. These soils are on flood plains of the Little Bear and Cub Rivers. Elevation ranges from 4,450 to 4,500 feet, and slopes are 0 to 1 percent. The vegetation is saltgrass, Kentucky bluegrass, sedges, wiregrass, and gumweed. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Kirkham soils are associated with Shay and Winn soils.

In a representative profile, the surface soil is grayish-brown, moderately alkaline silt loam about 9 inches thick. The next layer is grayish-brown, mildly alkaline silty clay loam about 14 inches thick. Below this, to a depth of 60 inches and more, is light brownish-gray, mildly alkaline heavy silt loam that is highly stratified. The profile is strongly calcareous throughout.

Kirkham soils are used for irrigated crops and unimproved pasture.

Kirkham-Shay complex (Ks).—This complex is mostly on the flood plain of the Little Bear and Cub Rivers. About 60 percent of the complex is Kirkham silt loam and about 40 percent is Shay silty clay loam. Slopes range from 0 to 1 percent.

Representative profile of Kirkham silt loam in an area of Kirkham-Shay complex, located north of Richmond, 1,200 feet south and 300 feet west of the northeast corner of sec. 21, T. 14 N., R. 1 E.:

Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; strongly calcareous; moderately alkaline; abrupt, smooth boundary.

C1—9 to 15 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many medium pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

C2—15 to 23 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many medium and fine pores; few, fine, distinct mottles; strongly calcareous; mildly alkaline; clear, wavy boundary.

C3—23 to 60 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, sticky and plastic; few fine roots; many fine and medium pores and a few large pores; few, fine, faint mottles; strongly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to grayish brown in a hue of 10YR. Texture ranges from silt loam to light silty clay loam. Reaction ranges from mildly alkaline to strongly alkaline. The C horizon ranges from grayish brown or light brownish gray to gray or pale brown in hues of 10YR and 2.5Y. This horizon is highly stratified. It ranges from silty clay loam to silt loam that has thin strata of fine sandy loam or loamy fine sand. In places gravel and sand are at a depth below 40 inches. The water table fluctuates seasonally and with the water level in the streams, but it commonly is at a depth below 30 to 50 inches. In years when runoff is high, this soil is subject to overflow for short periods.

This soil is fairly easy to till. Permeability is moderately slow. Runoff is slow, and the hazard of erosion is slight. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more.

Included in mapping were small areas of Winn silt loam, 0 to 3 percent slopes, and small areas of gravelly alluvial land.

Soils of this mapping unit are used for irrigated crops of sugar beets, alfalfa, small grain, and corn for silage. Some areas are in native pasture. (Capability unit IIw–2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Kirkham-Shay complex, strongly alkali (Kt).—This complex is on the Cub River flood plain, mainly near its junction with the Bear River. About 50 percent of the complex is Kirkham silt loam, and about 50 percent is Shay silty clay loam. These soils are similar to other Kirkham and Shay soils, except that they are strongly affected by salt and alkali. In addition, stratification in the profile is not so pronounced and strata of gravel and sand are thin or entirely absent. The surface is uneven and is dotted with oxbows and wet spots.

Included in mapping were small areas of Airport silty clay loam, 0 to 1 percent slopes.

Soils of this mapping unit are used mainly for native pasture. Small areas surrounded by larger tracts of other soils are used for irrigated or dryfarmed crops of alfalfa and small grain. (Capability unit IVw–28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Lakewin Series

The Lakewin series consists of somewhat excessively drained soils. These soils formed in mixed sandy and gravelly alluvium and modified lake sediment derived from limestone, quartzite, and sandstone. They are on old lake bars and medium lake terraces. Elevations range from 4,740 to 4,800 feet, and slopes range from 0 to 3 percent. The vegetation is Indian ricegrass, cheatgrass, annual sunflower, big rabbitbrush, and big sagebrush. The average annual precipitation is 15 to 17 inches, the mean annual air temperature is 46° to 47° F., and the frost-free season is 120 to 140 days. Lakewin soils are associated with Sterling, Ricks, Layton, and Kidman soils.

In a representative profile, the surface layer is dark grayish-brown, neutral to mildly alkaline gravelly coarse sandy loam about 18 inches thick. The next layer is brown, mildly alkaline gravelly loamy sand or gravelly sandy loam about 9 inches thick. Below this is light brownish-gray, strongly calcareous, moderately alkaline gravel and sand to a depth of 60 inches or more.

Lakewin soils are used mainly for dryfarming.

Lakewin gravelly coarse sandy loam (La).—This soil is on old lake bars or intermediate lake terraces south and west of the city of Hyrum. Slope ranges from 0 to 2 percent.

Representative profile one-half mile east of Sterling Crossroads, 800 feet south of the northwest corner of the northeast quarter of sec. 13, T. 10 N., R. 1 W.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; common fine and medium roots; 25 percent fine gravel; many fine pores; neutral; clear, smooth boundary.

A1—7 to 18 inches, dark grayish-brown (10YR 4/2) gravelly coarse sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; few medium roots and common fine roots; 25 percent gravel; many fine and medium pores; mildly alkaline; clear, wavy boundary.

C1—18 to 27 inches, brown (10YR 5/3) gravelly loamy sand, dark brown (10YR 3/3) when moist; single grain; loose, nonsticky and nonplastic; many fine roots; many fine and medium pores; noncalcareous; 30 percent gravel; mildly alkaline; gradual, wavy boundary.

C2ca—27 to 34 inches, brown (10YR 5/3) gravelly loamy sand, dark brown (7.5YR 3/4) when moist; single grain; loose, nonsticky and nonplastic; common fine roots; slightly calcareous, but strongly calcareous coatings on underside of pebbles; 40 percent gravel; mildly alkaline; clear, wavy boundary.

C3ca—34 to 60 inches, light brownish-gray (10YR 6/2) very gravelly sand, brown (10YR 5/3) when moist; single grain; loose, nonsticky and nonplastic; strongly calcareous; 40 percent gravel; moderately alkaline.

The A horizon ranges from dark grayish brown to brown. Texture ranges from gravelly coarse sandy loam to gravelly sandy loam. The pebbles are mostly less than one-half inch in diameter, and the gravel content ranges from 15 to 30 percent. The C horizon ranges from brown or light brownish gray to light brown or pale brown in a hue of 10YR or 7.5YR. Texture ranges from gravelly loamy sand to gravelly sandy loam in the upper part of the horizon and to gravel and sand in the lower part. Gravel content ranges from 20 to 40 percent in the C1 horizon and from 25 to 75 percent in the C2ca horizon. The underside of many of the pebbles in the C2ca horizon is coated with lime. Reaction ranges from mildly alkaline to strongly alkaline.

Included in mapping were small areas of Kidman fine sandy loam, 0 to 2 percent slopes.

The Lakewin soil is fairly easy to till, but gravel causes excessive wear on tillage implements. Permeability is rapid. Runoff is slow or very slow, and the hazard of erosion is slight. This soil holds 3.0 to 3.75 inches of available water to a depth of 5 feet. Roots are mostly in the upper 2 to 3 feet, and only a few roots extend into the very gravelly material.

This soil is used mainly for dryfarmed crops of small grain. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

LaPlatta Series

The LaPlatta series consists of well-drained soils that formed in residuum derived from light-colored tuff, conglomerate, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are on dominantly north- and east-facing mountain slopes at elevations of 5,000 to 7,000 feet. Slopes range from 10 to 50 percent. The vegetation is bluebunch wheatgrass, Great Basin wildrye, tall native bluegrass, Sandberg bluegrass, big sagebrush, bitterbrush, and serviceberry. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 40° to 44° F., and the frost-free season is 80 to 100 days. La Platta soils are associated with Barfuss, Leatham, Wheelon, Munk, and Obray soils.

In a representative profile, the surface layer is very dark gray, slightly acid silty clay loam about 8 inches thick. The subsoil is very dark-gray to light brownish-gray, slightly acid or neutral clay about 40 inches thick. The substratum is white, strongly calcareous, strongly alkaline silt loam to a depth of 60 inches or more. Carbonates have been leached from the surface layer and subsoil and redeposited in the substratum.

Representative profile of LaPlatta silty clay loam in an area of Barfuss-Leatham association (30 to 50 percent slopes) approximately 400 feet north and 1,600 feet west of the southeast corner of sec. 5, T. 9 N., R. 1 E.:

A1—0 to 8 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; hard, firm, sticky and slightly plastic; many fine and very fine roots; common, very fine, dicontinuous, exped, interstitial pores; slightly acid; clear, smooth boundary.

B21t—8 to 12 inches, very dark gray (10YR 3/1) silty clay, black (10YR 2/1) when moist; strong, medium, subangular blocky structure; very hard, very firm, sticky and plastic; common fine and very fine roots; few very fine tubular pores; few thin clay films on pores; slightly acid; gradual, smooth boundary.

B22t—12 to 26 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) when moist; strong, coarse, prismatic structure; extremely hard, very firm, very sticky and plastic; common fine and very fine roots; few very fine pores; common thin clay films in pores and on ped surfaces; slightly acid; gradual, wavy boundary.

B23t—26 to 35 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) when moist; strong, coarse, prismatic structure; extremely hard, very firm, very sticky and plastic; few very fine roots; common very fine tubular pores; common thin clay films in pores and on peds; neutral; clear, smooth boundary.

B3ca—35 to 48 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak subangular blocky structure; hard, firm, sticky and slightly plastic; common fine roots; common very fine interstitial pores; strongly calcareous, lime is nonindurated, massive, and nodular; strongly alkaline; gradual, wavy boundary.

Cca—48 to 60 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; common very fine interstitial pores; very strongly calcareous, lime is nonindurated and massive; strongly alkaline.

The combined thickness of the A1 and B2t horizons ranges from 28 to 40 inches over the horizon of accumulated carbonate. Carbonates generally are in the lower part of the B horizon but, in places, are in only the Cca and C horizons. The A1 horizon ranges from very dark gray to dark gray. Texture is dominantly silty clay loam but ranges to silt loam. Reaction ranges from slightly acid to mildly alkaline. Thickness is 5 to 11 inches. The B2t horizon ranges from very dark gray or dark grayish brown to grayish brown. Texture ranges from clay or silty clay to heavy silty clay loam. Reaction ranges from slightly acid to mildly alkaline. The soil generally is noncalcareous, but in places it is slightly calcareous in the lower part below a depth of 28 inches. The Cca and C horizons range from white to light grayish brown or pale brown in a hue of 10YR or 2.5Y. Texture ranges from silt loam or very fine sandy loam to silty clay loam. Reaction ranges from mildly alkaline to strongly alkaline, and these horizons are strongly calcareous to very strongly calcareous.

LaPlatta soils are used for range, watershed, and wildlife habitat.

LaPlatta silty clay loam, 30 to 50 percent slopes (LCG).—This steep soil is on north- and east-facing mountain slopes, south of Hardware Ranch and west of Anderson Ranch.

Permeability is moderately slow. Runoff is rapid, and the hazard of erosion is high. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more, but are mostly at a depth of less than 30 inches.

This soil is used for range, watershed, and wildlife habitat. Capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3)

LaPlatta-Obray association (6 to 30 percent slopes) (LGE).—This mapping unit is mostly in the Davenport Creek and Little Bear River drainage area. A smaller area is on the Clarkston Mountain. About 55 percent of the association is LaPlatta silty clay loam, 10 to 30 percent slopes; 25 percent is Obray silty clay, 6 to 20 percent slopes; 15 percent is Barfuss silt loam, 10 to 30 percent slopes; and 5 percent is included soils.

The strongly sloping to moderately steep LaPlatta soil is on slightly concave mountain slopes. The vegetation is sagebrush, slender wheatgrass, tall native bluegrass, yarrow, geranium, and scattered clumps of scrubby aspen. Runoff is medium, and the hazard of erosion is moderate.

The strongly sloping Obray soil is in terracelike areas between steep slopes. The vegetation is mulesear dock, slender wheatgrass, low sagebrush, and Sandberg bluegrass.

The Barfuss soil is on slightly convex ridges and moderately steep mountain slopes. It is described under the Barfuss series. The vegetation is sagebrush, bitterbrush, Great Basin wildrye, and western wheatgrass. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were areas of a deep, fine-textured, extremely stony soil and areas of Leatham silt loam, 30 to 50 percent slopes. The extremely stony soil makes up 3 percent of the association and is in shallow gullies. The Leatham soil makes up 2 percent of the association and is on convex ridges.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (LaPlatta soil is in capability unit VIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. Obray soil is in capability unit VIe–M5, nonirrigated; Mountain Clay range site. Barfuss soil is in capability unit VIIe–MN; not in a range site. None of the soils is in a woodland suitability group; all of the soils are in wildlife suitability group 3)

Lasil Series

The Lasil series consists of somewhat poorly drained soils that are affected by salt and alkali. These soils formed in mixed lake sediment. They are on low lake terraces at elevations of 4,430 to 4,500 feet. Slopes range from 0 to 3 percent. The vegetation is greasewood, saltgrass, foxtail, gumweed, and annual mustard. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Lasil soils are associated with Jordan, Trenton, and Cache soils.

In a representative profile, the surface layer is light brownish-gray, neutral silty clay loam about 5 inches thick. The subsoil is light brownish-gray, pinkish-gray, and brown, moderately alkaline heavy silty clay loam about 34 inches thick. The substratum is light-brown, moderately alkaline or strongly alkaline heavy silty clay loam to a depth of 60 inches or more.

Representative profile of Lasil silty clay loam in an area of Jordan-Lasil silty clay loams, ½ mile north and ¾ mile west of Amalga Church, 800 feet south and 1,100 feet west of the northwest corner of sec. 24, T. 13 N., R. 1 W.:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy structure that parts to weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; slightly calcareous; neutral; abrupt, smooth boundary.

B1—5 to 13 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; slightly calcareous; moderately alkaline; clear, smooth boundary.

B21t—13 to 23 inches, pinkish-gray (7.5YR 6/2) heavy silty clay loam, brown (7.5YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, fine subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many fine pores; thin continuous clay films; slightly calcareous; moderately alkaline; gradual, smooth boundary.

B22t—23 to 32 inches, pinkish-gray (7.5YR 6/2) heavy silty clay loam, brown (7.5YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, fine, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; common fine pores; thin continuous clay films; moderately calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—32 to 39 inches, brown (7.5YR 5/2) heavy silty clay loam, dark brown to brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine and medium pores; moderately calcareous; moderately alkaline; gradual, smooth boundary.

Cca—39 to 60 inches, light-brown (7.5YR 6/3) heavy silty clay loam, brown (7.5YR 5/3) when moist; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; massive; very hard, firm, sticky and very plastic; few fine pores; strongly calcareous; moderately alkaline.

The combined thickness of the A1, B1, and B2t horizons ranges from 27 to 33 inches above the ca horizon. The A1 horizon ranges from grayish brown to dark grayish brown or brown. Texture is dominantly silty clay loam but ranges to heavy silt loam. Reaction ranges from neutral to moderately alkaline. Thickness ranges from 3 to 8 inches. The B2t horizon is pinkish gray to brown or to light brown. Texture ranges from heavy silty clay loam to silty clay loam. Reaction is moderately alkaline to very strongly alkaline. The exchangeable sodium percentage ranges from 20 to 50. The Cca horizon is light brown to pinkish gray. Texture ranges from heavy silt loam to heavy silty clay. Reaction ranges from moderately alkaline to very strongly alkaline. The exchangeable sodium percentage ranges from 20 to 70. The calcium carbonate equivalent is 15 to 30 percent. Distinct, yellowish-red (5YR 5/6) to strong-brown (7.5YR 5/6) mottles are at a depth below 32 inches.

Permeability is very slow. Runoff is slow, and the hazard of erosion is slight to none. These soils hold 3 to 6 inches of available water to a depth of 5 feet. Roots are mostly in the uppermost 20 inches, above the horizon that contains strong alkali.

Lasil soils are mainly used for native range. A few small areas are cultivated.

In this survey area, the Lasil soils are not mapped separately but are mapped in a complex with Jordan soils.

Layton Series

The Layton series consists of moderately well drained soils that formed in mixed lake sediment derived dominantly from sandstone, limestone, and quartzite. These soils are on medium terraces on the Lewiston Bench at elevations of 4,400 to 4,550 feet. Slopes range from 0 to 1 percent. The vegetation is Indian ricegrass, bluebunch wheatgrass, cheatgrass, big rabbitbrush, and big sagebrush. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 130 to 140 days. Layton soils are associated with Kidman, Lewiston, Preston, and Timpanogos soils.

In a representative profile, the surface layer is dark grayish-brown to brown, neutral to mildly alkaline loamy fine sand about 13 inches thick. The next layer is brown, moderately alkaline loamy fine sand about 14 inches thick. The substratum is brown to light-brown, moderately alkaline loamy fine sand and fine sand to a depth of 60 inches or more. Carbonates have mostly been leached from the surface layer and subsoil and accumulated in the substratum at a depth of 36 to 50 inches.

Layton soils are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage.

Layton loamy fine sand (Lh).—This slightly undulating soil is on lake terraces at medium elevations, mainly in the Lewiston-Cornish area. Slopes are 0 to 1 percent.

Representative profile in an irrigated area, 1¼ miles north and ⅜ mile west of Lewiston, 1,000 feet north and 800 feet east of the southwest corner of the southeast quarter of sec. 32, T. 15 N., R. 1 E.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loamy fine sand, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure to single grain; soft, very friable, nonsticky and nonplastic; many fine roots; neutral; abrupt, smooth boundary.

A1—6 to 13 inches, brown (10YR 4/3) loamy fine sand, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine pores and few large pores; noncalcareous; mildly alkaline; clear, wavy boundary.

AC—13 to 27 inches, brown (7.5YR 5/2) loamy fine sand, dark brown (7.5YR 3/2) when moist; massive; soft, very friable, nonsticky and nonplastic; many fine roots; many fine, medium, and large pores; noncalcareous; moderately alkaline; gradual, wavy boundary.

C1—27 to 35 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many medium and fine pores; noncalcareous; moderately alkaline; gradual, wavy boundary.

C2—35 to 46 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) when moist; common, medium, distinct, yellowish-red (5YR 4/6) mottles; massive; soft, very friable, nonsticky and nonplastic; few fine roots; many fine pores; noncalcareous; moderately alkaline; clear, wavy boundary.

C3ca—46 to 66 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; common, coarse, distinct, dark reddish-brown (5YR 3/4) mottles; massive; soft, very friable, nonsticky and nonplastic; moderately calcareous; moderately alkaline.

The A horizon ranges from dark grayish brown to grayish brown or to brown in a hue of 10YR. Texture ranges from loamy fine sand to light fine sandy loam. Reaction is neutral to mildly alkaline. Thickness ranges from 6 to 14 inches. The C horizon ranges from brown to light brown or pale brown in a hue of 7.5YR or 10YR. Texture ranges from loamy fine sand to fine sand or to light fine sandy loam. The calcium carbonate equivalent of the C3ca horizon ranges from 8 to 20 percent. Depth to the water table and reddish-brown mottles is most commonly from 40 to 60 inches. In places the substratum is strongly calcareous.

This soil is rapidly permeable. Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is slight to moderate. This soil holds 5 to 7 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet.

Included with this soil in mapping were small areas of Layton soils that have slopes of 1 to 3 percent, and areas of well-drained soils.

This soil is used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage. (Capability unit IIIs-24, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Leatham Series

The Leatham series consists of well-drained soils that formed in material weathered from light-colored, very strongly calcareous, tuff, conglomerate, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are mainly on south- and west-facing mountain slopes at elevations of 5,200 to 6,000 feet. Slopes range from 30 to 50 percent. The vegetation is bluebunch wheatgrass, native bluegrass, giant wildrye, cheatgrass, oyster plant, mulesear dock, balsamroot, bitterbrush, big sagebrush, and serviceberry. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature is 42° to 45° F., and the frost-free season is 80 to 100 days. Leatham soils are associated with Barfuss, LaPlatta, and Wheelon soils.

In a representative profile, the surface layer is gray, strongly calcareous, neutral silt loam about 10 inches thick. The next layer and the substratum are light-gray to white, very strongly calcareous, mildly alkaline silt loam or light silty clay loam to a depth of 60 inches or more.

Leatham soils are used for range, watershed, and wildlife habitat.

Leatham-Barfuss association, eroded (30 to 50 percent slopes) (LMG2).—This mapping unit is on the rolling foothills east of the Smithfield-Richmond area. About 50 percent of the association is Leatham silt loam, 30 to 50 percent slopes; 20 percent is Barfuss silt loam, 30 to 50 percent slopes; 20 percent is Wheelon silt loam, 30 to 50 percent slopes; and 10 percent is included soils.

Generally the Leatham soil has slopes that face south and west; the Wheelon soil is on convex ridges; and the Barfuss soil is in slightly concave areas and has north-facing slopes. The vegetation on these soils is perennial grasses, forbs, and shrubs.

Representative profile of Leatham silt loam, 30 to 50 percent slopes, in an area of Leatham-Barfuss association, eroded, 1½ miles east of Crow Mountain, 1,000 feet west of the east quarter corner of sec. 12, T. 13 N., R. 1 E.:

A11—0 to 4 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, medium, platy structure that parts to moderate, fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine, medium, and large roots; many fine pores; strongly calcareous; neutral; abrupt, smooth boundary.

A12—4 to 10 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, coarse, subangular blocky structure that parts to moderate, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine, medium, and large roots; many fine and medium pores and a few large pores; strongly calcareous; neutral; clear, wavy boundary.

AC—10 to 15 inches, light-gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many fine and medium roots and a few large roots; many fine and medium pores and a few large pores; very strongly calcareous; mildly alkaline; gradual, wavy boundary.

C1ca—15 to 25 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky structure; very hard, friable, nonsticky and slightly plastic; many fine and medium roots and a few large roots; many fine and medium pores; very strongly calcareous; mildly alkaline; gradual, wavy boundary.

C2ca—25 to 39 inches, white (2.5Y 8/1) silty clay loam, light gray (2.5Y 7/2) when moist; massive; very hard, very friable, nonsticky and slightly plastic; few fine roots; many fine and medium pores; very strongly calcareous; mildly alkaline; gradual, irregular boundary.

C3ca—39 to 60 inches, same as C2ca horizon except that it contains many pockets of weathering volcanic ash that is noncalcareous and has colors lighter than N 8/0; these pockets make up about one-third of the volume of the horizon.

The A horizon ranges from 8 to 12 inches in thickness.

Permeability is moderate. Runoff is rapid, and the hazard of erosion is high. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were areas of LaPlatta silty clay loam, 10 to 30 percent slopes, in depressions and swales.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Leatham soil is in capability unit VIIe-U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2. Barfuss soil is in capability unit VIIe-MN, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3)

Lewiston Series

The Lewiston series consists of somewhat poorly drained soils that are affected by salt and alkali. These soils formed in mixed lake sediment derived from limestone and sandstone rocks. They are on low lake terraces, mainly in the Lewiston-Trenton area, at elevations of 4,430 to 4,500 feet. Slopes range from 0 to 3 percent. The vegetation is saltgrass, foxtail, alkali sacaton, and Great Basin wildrye. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 130 to 150 days. Lewiston soils are associated with Kidman, Layton, and Trenton soils.

In a representative profile, the surface layer is grayish-brown to brown, mildly alkaline to moderately alkaline very fine sandy loam about 13 inches thick. The next layer is light-gray, moderately alkaline or strongly alkaline fine sandy loam about 19 inches thick. Below this is pinkish-gray, strongly alkaline loamy fine sand to a depth of 60 inches or more.

Lewiston soils are used for irrigated crops and pasture.

Lewiston fine sandy loam (Ln).—This soil is mostly on low lake terraces in the vicinity of Lewiston and south to the Benson area. Slopes range from 0 to 3 percent.

Representative profile in a cultivated field, 1¼ miles west and 1¼ miles south of Lewiston, 850 feet north and 110 feet east of the southwest corner of the northeast quarter of sec. 18, T. 14 N., R. 1 E.:

Ap—0 to 10 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular and weak, coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few fine pores; slightly calcareous; mildly alkaline; clear, smooth boundary.

A1—10 to 13 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, fine, granular and weak, coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; few fine pores; slightly calcareous; moderately alkaline; clear, wavy boundary.

C1ca—13 to 22 inches, light-gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) when moist; common, medium, faint, grayish-brown (10YR 5/2) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few fine roots; many fine and medium pores; strongly calcareous; moderately alkaline; clear, smooth boundary.

C2ca—22 to 32 inches, light-gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; common, medium, faint, yellowish-brown (10YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few fine pores; strongly calcareous; strongly alkaline.

C3—32 to 60 inches, pinkish-gray (7.5YR 7/2) loamy fine sand, light brown (7.5YR 6/4) when moist; many, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few fine pores; strongly calcareous; strongly alkaline.

The A horizon ranges from grayish brown to dark grayish brown or to brown. Reaction ranges from mildly alkaline to strongly alkaline. Thickness ranges from 8 to 16 inches. The C and Cca horizons range from brown to pale brown, light brown, or pinkish gray in a hue of 10YR or 7.5YR. Texture ranges from fine sandy loam to light loam or to loamy fine sand. Distinct, yellowish-brown or yellowish-red mottles are in the subsoil and substratum.

This soil is easy to till. Permeability is moderately rapid. Runoff is slow or very slow, and the hazard of erosion is slight. This soil holds 5 to 7 inches of available water to a depth of 5 feet. The water table is at a depth ranging from 30 to 40 inches and fluctuates seasonally. Roots penetrate easily to the water table.

Included in mapping were small areas of Kidman fine sandy loam, deep water table, 0 to 2 percent slopes, a few small areas of soils that have a hardpan, and areas of alkali soils.

This soil is used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage, and for improved pasture. (Capability unit IIw-26, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Lewiston fine sandy loam, strongly alkali (Lo).—This soil is in lower lying areas on low lake terraces. It is similar to Lewiston fine sandy loam, but because of its low position, the water table is higher. The depth to the water table is 10 to 30 inches. This high water table has caused a strong accumulation of alkali and moderate amounts of salts near the surface.

This soil is used for irrigated crops of barley and alfalfa, or for improved pasture or range. (Capability unit IVw-28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Logan Series

The Logan series consists of poorly drained and very poorly drained soils that have a heavy silty clay loam subsoil. These soils formed in mixed alluvium and lake sediment derived from limestone, sandstone, and quartzite. They are on flood plains of streams and low lake terraces at elevations of 4,420 to 4,500 feet. Slopes range from 0 to 3 percent. The vegetation is saltgrass, Kentucky bluegrass, wiregrass, sedges, and cattails. The average annual precipitation is 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Logan soils are associated with Roshe Springs, Salt Lake, Cardon, Collett, Greenson, and Airport soils.

In a representative profile, the surface layer is very dark gray, mildly alkaline, strongly calcareous silty clay loam about 13 inches thick. The next layer is gray, moderately alkaline, very strongly calcareous heavy silty clay loam about 13 inches thick. Below this is light-gray, moderately alkaline, strongly calcareous silty clay to a depth of 60 inches or more. The substratum is gleyed.

Logan soils are used mostly for native pasture and meadow hay. Some areas have been drained and are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage, and for improved pasture.

Logan silty clay loam (Lr).—This soil is in smooth areas or in slight depressions on low lake terraces and flood plains in the central part of Cache Valley. Slopes range from 0 to 3 percent.

Representative profile, located in a wet meadow area, 1 mile south and 1 mile east of Mendon Post Office, 1,100 feet south and 500 feet east of the northwest corner of the northeast quarter of sec. 16, T. 11 N., R. 1 W.:

O2—2 inches to 0, peat.

A1—0 to 13 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; slightly hard, friable, sticky and plastic; many fine, medium, and large roots; common fine pores; strongly calcareous; mildly alkaline; gradual, smooth boundary.

C1cag—13 to 26 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, dark gray (2.5Y 4/1) when moist; massive; hard, firm, sticky and plastic; common fine roots and few medium roots; many fine and medium pores; very strongly calcareous; moderately alkaline; clear, smooth boundary.

C2g—26 to 45 inches, light-gray (5Y 7/1) silty clay, gray (5Y 6/1) when moist; massive; extremely hard, very firm, very sticky and very plastic; few fine and medium roots; common fine pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C3g—45 to 60 inches, light-gray (5Y 7/1) silty clay, olive gray (5Y 5/2) when moist; common, medium, distinct, grayish-brown (10YR 5/2) mottles; massive; extremely hard, very firm, very sticky and very plastic; few fine and medium roots; common fine pores; strongly calcareous; moderately alkaline.

A peat horizon as much as 2 inches thick is on the surface in areas where this soil has not been cultivated. The A1 horizon ranges from 10 to 16 inches in thickness and from heavy silt loam to silty clay loam in texture. Mottles of grayish brown to yellowish brown commonly occur below a depth of 20 inches.

This soil is easy to till if it is drained. Permeability is slow. Runoff is slow to ponded, and the hazard of erosion is none to slight. If this soil is drained, it holds 9 to 11 inches of available water to a depth of 5 feet. The depth to the water table commonly is 14 to 40 inches, but some areas are ponded for part of the year. In places this soil has been drained and the water table is below a depth of 40 inches. Most plant roots are above the water table.

Included in mapping were small areas of Greenson loam, 0 to 3 percent slopes, and small areas of Salt Lake silty clay. Also included were a few small areas of soils that are affected by salt and alkali.

This soil is used mainly for meadow hay and pasture. Some small areas are drained and are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage. (Capability unit IIIW-25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Lucky Star Series

The Lucky Star series consists of well-drained soils that formed in residuum and colluvium derived dominantly from sandstone. These soils are on mountains at elevations of 7,000 to 8,500 feet. Slopes range from 6 to 60 percent. The vegetation is aspen and an understory of snowberry, chokeberry, mountain brome, blue wildrye, slender wheatgrass, bluebell, peavine, and oniongrass. The average annual precipitation is 25 to 35 inches, the mean annual air temperature is 36° to 46° F., and the mean soil temperature is less than 59°. The frost-free season is 80 to 100 days. Lucky Star soils are associated with Agassiz, Curtis Creek, Despain, Fitzgerald, Flygare, Goring, Hoskin, Mult, Red Spur, and Scout soils.

In a representative profile, the surface layer is very dark grayish-brown, slightly acid gravelly silt loam about 13 inches thick. The subsurface layer is pink, medium acid very cobbly fine sandy loam about 22 inches thick. Below this is a layer of light-brown and reddish-brown, medium acid to slightly acid very cobbly fine sandy loam and very cobbly sandy clay loam about 35 inches thick. The substratum is light-brown, slightly acid very cobbly light loam to a depth of 72 inches or more.

Lucky Star soils are used for range, watershed, woodland, and wildlife habitat.

Lucky Star gravelly silt loam, 30 to 60 percent slopes (LTG).—This soil is on the sides of mountains.

Representative profile, located in south Cottonwood Canyon, 2,400 feet west and 1,800 feet north of the southeast corner of sec. 31, T. 10 N., R. 3 E.:

O1—1 inch to 0, matted leaves and twigs.

A1—0 to 13 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many medium and fine roots and few large roots; 30 percent gravel and cobblestones; slightly acid.

A2—13 to 35 inches, pink (7.5YR 7/3) very cobbly fine sandy loam, brown (7.5YR 5/3) when moist; massive; soft, very friable, nonsticky and nonplastic; common medium and very fine roots and few large roots; common medium and fine interstitial pores; 50 to 60 percent cobblestones and gravel; medium acid; gradual, irregular boundary.

A2&B2t—35 to 55 inches, mixed A2 and B2t horizons (60 percent A2, and 40 percent B2t); the A2 part is light-brown (7.5YR 6/4) very cobbly fine sandy loam, brown (7.5YR 5/4) when moist; the B2t part is reddish-brown (5YR 5/4) very cobbly sandy clay loam, reddish brown (5YR 4/4) when moist; massive; soft, friable, slightly sticky and nonplastic; common fine and medium roots and few large roots; few medium and many very fine interstitial pores; 50 to 60 percent cobblestones and gravel; many clay films in pores and on cobblestones and gravel, and very few on ped surfaces; medium acid; clear, wavy boundary.

B2t&A2—55 to 70 inches, mixed B2t and A2 horizons (60 percent B2t, and 40 percent A2); the B2t part is reddish-brown (5YR 5/4) very cobbly sandy clay loam, reddish brown (5YR 4/4) when moist, and the A2 part is light-brown (7.5YR 6/4) very cobbly fine sandy loam, brown (7.5YR 5/4) when moist; moderate, medium, prismatic structure; hard, firm, sticky and plastic; moderately thick continuous clay films on ped surfaces and common moderately thick clay films in pores; few medium and fine roots; common medium and large pores; 50 to 70 percent cobblestones and gravel; slightly acid; clear, irregular boundary.

C—70 to 72 inches, light-brown (7.5YR 6/4) very cobbly light loam, mixed brown (7.5YR 5/4) and reddish brown (5YR 4/4) when moist; very cobbly clay loam; massive; soft and hard, friable and firm, nonsticky and sticky, and nonplastic and plastic; few medium and fine roots; many medium and large interstitial pores; 50 to 70 percent cobblestones and gravel; slightly acid.

The combined thickness of the A1, A2, and B2t horizons ranges from 50 to 70 inches. The A1 horizon ranges from very dark grayish brown to dark brown in a hue of 10YR or 7.5YR. Reaction ranges from medium acid to neutral. Thickness ranges from 10 to 16 inches. The A2 horizon ranges from pink to light brown, very pale brown, or pale brown in a hue of 10YR, 7.5YR, or 5YR. Texture ranges from very cobbly fine sandy loam or cobbly fine sandy loam to very cobbly loamy fine sand. The A2 horizon tongues into the B2t horizon. The B2t horizon ranges from reddish brown to red or pink in a hue of 7.5YR, 5YR, or 2.5YR. Texture ranges from very cobbly sandy clay loam or very cobbly heavy loam to very cobbly light clay loam. Angular or rounded sandstone and quartzite fragments the size of cobblestones and gravel are throughout the profile. The content of coarse fragments ranges from 10 to 30 percent in the A1 horizon, from 30 to 70 percent in the A2 horizon, and from 50 to 80 percent in the B2t and C horizons.

Permeability is moderate. This soil holds about 5 to 7 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more. Runoff is rapid, and the hazard of erosion is high.

Included in mapping were areas of Scave silt loam, 10 to 30 percent slopes, and small areas of soils that have an extremely stony surface layer.

This soil is used for range, watershed, woodland, and wildlife habitat. (Capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2r1; wildlife suitability group 4)

Lucky Star silt loam, 6 to 30 percent slopes (LSE).—This soil is on mountains. It is similar to Lucky Star silt loam, 30 to 60 percent slopes, except that it is not so steep and its surface layer is essentially free of gravel and cobblestones. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Lucky Star gravelly silt loam, 30 to 60 percent slopes, and areas of St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes. Also included are small areas of Scout soils and areas where the surface layer is extremely stony.

This Lucky Star soil is used for range, watershed, woodland, and wildlife habitat. (Capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Lucky Star-Goring association (6 to 30 percent slopes) (LUE).—This mapping unit consists of soils on mountains, mostly west of Ant Flat Road near the Weber County line, and in smaller scattered areas. About 65 percent of the association is Lucky Star silt loam; about 25 percent is Goring silt loam; and 10 percent is included soils.

The Lucky Star soil is similar to Lucky Star gravelly silt loam, 30 to 60 percent slopes, except that it is less sloping and its surface layer is essentially free of gravel and cobblestones. The vegetation is aspen. On the Goring soil the vegetation is grasses, shrubs, and forbs.

Included in mapping were areas of Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded, and Ant Flat loam, 6 to 20 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Lucky Star soil is in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; and wildlife suitability group 4. Goring soil is in capability unit VIe–M, nonirrigated; Mountain Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Lucky Star-Hoskin association (6 to 30 percent slopes) (LVE).—This mapping unit is on the north-facing slopes of mountains in the La Plata mine area. About 70 percent of the association is Lucky Star silt loam, 6 to 30 percent slopes; 25 percent is Hoskin cobbly loam, 10 to 30 percent slopes; and about 5 percent is included soils.

The Lucky Star soil is similar to Lucky Star gravelly silt loam, 30 to 60 percent slopes, except that it is less sloping and its surface layer is essentially free of gravel and cobblestones. The vegetation is aspen.

The Hoskin soil is similar to Hoskin silt loam, 30 to 70 percent slopes, except that it is less sloping and less eroded. The surface ranges from 10 to 15 inches in thickness. Runoff is medium, and the hazard of erosion is moderate. The vegetation is snowberry, chokecherry, and grasses.

Included in mapping were areas of Scout gravelly loam, 10 to 40 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Lucky Star soil is in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Hoskin soil is in capability unit VIe–M, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Lucky Star-Red Spur complex, 6 to 30 percent slopes (LWE).—This complex consists of soils on all exposures on the sides of high mountains west of Monte Cristo. Elevation ranges from 7,500 to 8,500 feet. About 45 percent of the complex is Lucky Star silt loam, 6 to 30 percent slopes; about 35 percent is Red Spur loam, 10 to 30 percent slopes; 17 percent is Agassiz rocky silt loam, 6 to 30 percent slopes; and 3 percent is included soils.

The Lucky Star soil is strongly sloping to steep. It is similar to Lucky Star gravelly silt loam, 30 to 60 percent slopes, except that it is less sloping and its surface layer is essentially free of gravel. The vegetation is aspen.

The Red Spur soil is moderately steep to steep. It is described under the Red Spur series. The vegetation is aspen and grass or shrubs and grass. The Agassiz soil is on spur ridges, where the vegetation is shrubs and grass.

Included in mapping were areas of Cluff silt loam, 6 to 30 percent slopes.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Lucky Star-Scout association (6 to 40 percent slopes) (LXE).—This mapping unit is on mountains, mostly north and east of Strawberry Valley. The exposures are mostly northern, but there are spur ridges that have eastern and western exposures. About 65 percent of the association is Lucky Star silt loam, 6 to 30 percent slopes; 25 percent is Scout gravelly loam, 10 to 40 percent slopes; and about 10 percent is included soils.

The Lucky Star soil has slopes that face east and west. It is similar to Lucky Star gravelly silt loam, 30 to 60 percent slopes, except that it is less sloping and its surface layer is essentially free of gravel and cobblestones. The vegetation is aspen.

The Scout soil has slopes that face north. On these slopes the vegetation is conifers.

Included in mapping were areas of St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes, on eastern and western exposures. Here, the vegetation is brush and grass.

Soils in this mapping unit are used for range, watershed, wildlife habitat, and woodland. (Lucky Star soil is in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Scout soil is in capability unit VIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4o1; wildlife suitability group 4)

Maughan Series

The Maughan series consists of well-drained soils that have a cobbly clay subsoil. These soils formed in residuum and colluvium derived from sandstone, shale, and limestone rocks. They are on north- and east-facing mountain slopes at elevations of 5,100 to 7,000 feet. Slopes range from 30 to 60 percent. The vegetation is bigtooth maple and an understory of slender wheatgrass, mountain brome, chokecherry, and scrubby aspen. The average annual precipitation is 20 to 25 inches, the mean annual air temperature is 42° to 45° F., and the frost-free season is 100 to 110 days. Maughan soils are associated with Datwyler, Elzinga, Sheep Creek, and Agassiz soils.

In a representative profile, the surface layer is very dark brown and very dark grayish-brown, neutral and slightly acid silt loam about 25 inches thick. The subsurface layer is light-brown, slightly acid, gravelly silt loam about 7 inches thick. The subsoil is reddish-brown cobbly clay and cobbly heavy clay loam to a depth of 66 inches or more.

Representative profile of Maughan silt loam, 30 to 60 percent slopes, in an area of Datwyler-Elzinga-Maughan complex, 30 to 60 percent slopes, 2 miles south and 1 mile west of Sterling crossroads, 500 feet north and 1,200 feet east of the southwest corner of sec. 22, T. 10 N., R. 1 W.:

A11—0 to 8 inches, very dark brown (10YR 2/2) light silt loam, black (10YR 2/1) when moist; moderate, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many fine, medium, and large roots; 10 percent gravel; neutral; gradual, smooth boundary.

A12—8 to 25 inches, very dark grayish-brown (10YR 3/2) silt loam, black (10YR 2/1) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium roots and few large roots; few, fine, interstitial pores; 10 percent gravel; slightly acid; clear, wavy boundary.

A2—25 to 32 inches, light-brown (7.5YR 6/4) gravelly silt loam, dark brown to brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; hard, friable, sticky and plastic; common fine and medium roots; many, fine and medium, interstitial and tubular pores; 20 percent gravel; slightly acid; clear, smooth boundary.

B21t—32 to 38 inches, reddish-brown (5YR 5/4) cobbly heavy clay loam, reddish brown (5YR 4/4) when moist; moderate, medium, prismatic structure; very hard, very firm, sticky and plastic; common fine and few medium roots; common, fine and medium, interstitial pores; common, thin, continuous clay films in pores; 30 percent gravel and cobblestones; medium acid; gradual, smooth boundary.

B22t—38 to 50 inches, reddish-brown (5YR 5/4) cobbly clay, reddish brown (5YR 4/4) when moist; moderate, medium, prismatic structure; extremely hard, extremely firm, sticky and very plastic; common fine roots; common, fine, interstitial pores; 30 percent gravel and cobblestones; common, moderately thick, continuous clay films on ped faces; slightly acid; gradual, smooth boundary.

B23t—50 to 66 inches, reddish-brown (5YR 5/4) cobbly light clay, reddish brown (5YR 4/4) when moist; weak, medium, prismatic structure; very hard, very firm, sticky and plastic; few fine roots; common, fine, interstitial pores; 30 percent weathering limestone cobblestones; common thin clay films in pores and some ped faces; neutral.

The A1 horizon ranges from 20 to 42 inches in thickness. The content of cobblestones and gravel ranges from 0 to 15 percent in the A1 horizon and from 20 to 35 percent in the A2 and B2t horizons. The A1 horizon ranges from very dark brown to dark gray. Reaction ranges from medium acid to neutral. Texture in the A2 horizon is gravelly light silt loam to gravelly heavy loam. Reaction in the A2 horizon is medium acid to slightly acid. The B2t horizon has hues of 7.5YR to 2.5YR. Texture in the B2t horizon ranges from cobbly clay or cobbly silty clay to cobbly heavy clay loam that is more than 35 percent clay. Reaction is medium acid to slightly acid. Thickness ranges from 20 to 40 inches or more.

Permeability is moderately slow to slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. These soils hold 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Maughan soils are used for range, watershed, and wildlife habitat.

Maughan-Datwyler association (30 to 60 percent slopes) (MAG).—This mapping unit is on the north end of the Wellsville Mountains. About 70 percent of the association is Maughan silt loam, 30 to 60 percent slopes, and about 30 percent is Datwyler cobbly silty clay loam, 30 to 60 percent slopes.

The Maughan soil has slopes that face north and east. The vegetation is maple and chokecherry and an understory of grasses and forbs.

The Datwyler soil is on ridges and has south-facing slopes. The vegetation is grass, shrubs, and forbs. In these areas the surface layer ranges from cobbly silty clay loam to gravelly loam.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Maughan soil is in capability unit VIIe-MN, nonirrigated; Mountain Loam (Shrubs) range site. Datwyler soil is in capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site; neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

McMurdie Series

The McMurdie series consists of well-drained soils that formed in mixed lake sediment derived dominantly from limestone, sandstone, and quartzite. These soils are on high lake terraces at elevations of 4,800 to 5,150 feet. Slopes range from 0 to 20 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, cheatgrass, balsamroot, and big sagebrush. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 130 to 150 days. McMurdie soils are associated with Parleys, Hillfield, Nebeker, Timpanogos, and Ricks soils.

In a representative profile (fig. 5), the surface layer is dark grayish-brown, neutral silt loam about 7 inches thick. The subsoil is dark grayish-brown, brown, and pale-brown, neutral silty clay loam and silty clay about 26 inches thick. The substratum is pale-brown, mildly alkaline, strongly calcareous loam and sandy loam to a depth of 60 inches or more.

McMurdie soils are used for irrigated crops and dry-farmed crops.

McMurdie silt loam, 3 to 6 percent slopes (McB).—This soil is on high lake terraces, mainly near the town of Paradise. Slopes are generally long.

Representative profile, 30 feet east of the northeast corner of Paradise Cemetery, 700 feet north of the southwest corner of the southeast quarter of sec. 27, T. 10 N., R. 1 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure and weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common fine roots; common fine pores; neutral; abrupt, smooth boundary.

B1—7 to 14 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) when moist; mod-

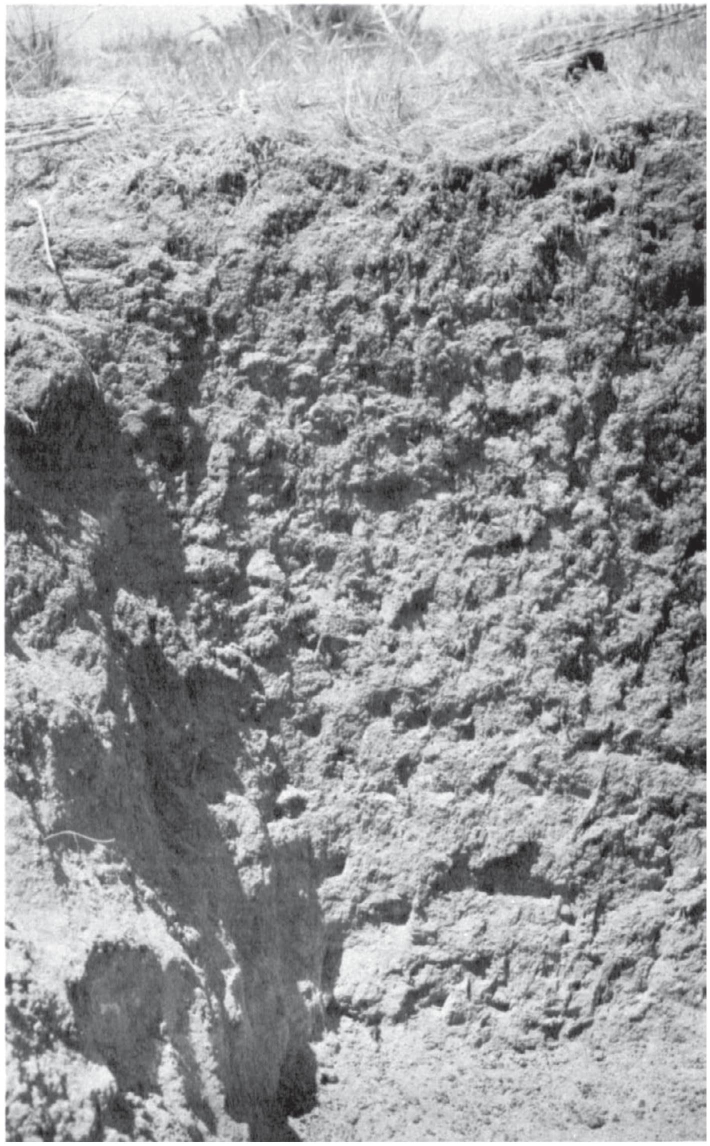

Figure 5.—Profile of McMurdie silt loam, 3 to 6 percent slopes.

erate, medium, subangular blocky structure that parts to moderate, fine, subangular blocky structure; very hard, firm, slightly sticky and plastic; common fine roots; many fine pores; few thin clay films; neutral; clear, wavy boundary.

B2t—14 to 33 inches, brown (7.5YR 5/2) silty clay, dark brown (7.5YR 3/2) when moist; strong, medium, prismatic structure that parts to strong, medium, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; common fine roots; common fine pores; common moderately thick clay films; neutral; clear, wavy boundary.

B3ca—33 to 43 inches, pale-brown (10YR 6/3) silty clay loam, brown (7.5YR 5/4) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; hard, firm, sticky and plastic; common fine roots; common fine and medium pores; few thin clay films; strongly calcareous; neutral; clear, wavy boundary.

C1ca—43 to 50 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; massive; hard, firm, sticky and plastic; few fine roots; common fine and medium pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

IIC2—50 to 60 inches, pale-brown; (10YR 6/3) sandy loam, brown (10YR 5/3) when moist; massive; soft, very friable, nonsticky and nonplastic; strongly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to brown or grayish brown. Texture ranges from silt loam to light silty clay loam. Thickness ranges from 7 to 12 inches. The B2t horizon ranges from brown to light brown in hues of 7.5YR and 10YR. Texture ranges from silty clay to heavy clay loam or heavy silty clay loam. Thickness ranges from 15 to 30 inches. The Cca and C horizons range from pale brown to brown or light brown in hues of 10YR and 7.5YR. Texture ranges from silty clay loam to sandy loam. Reaction is neutral to mildly alkaline, and the horizon is strongly calcareous. The ca horizon generally begins in the lower part of the B horizon.

Included in mapping were small areas of Hillfield silt loam. Also included were small areas of soils that have slopes of 1 to 3 percent and soils that have a silty clay loam surface layer.

This soil is fairly easy to till. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

This soil is used mostly for irrigated crops of alfalfa, small grain, and sugar beets. Some areas are used for dryfarmed crops. (Capability unit IIe–2, irrigated, IIe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

McMurdie silt loam, 0 to 3 percent slopes (McA).—This soil is on high lake terraces along the east side of Cache Valley. It is similar to McMurdie silt loam, 3 to 6 percent slopes, except that it is less sloping and its surface layer is 8 to 18 inches thick. Runoff is slow, and the hazard of erosion is none to slight.

This soil is used for irrigated crops. Alfalfa, small grain, sugar beets, peas, and corn for silage are common crops. (Capability unit IIc–2, irrigated, IIe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

McMurdie silt loam, 6 to 10 percent slopes (McC).—This soil is on high lake terraces. It is associated with McMurdie silt loam, 3 to 6 percent slopes, and is similar to that soil, except that it is more sloping. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Hillfield silt loam. Also included were small areas of soils that have slopes of slightly more than 10 percent.

This soil is used mainly for irrigated crops of alfalfa and small grain. Small areas are dryfarmed. (Capability unit IIIe–2, irrigated, IIIe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

McMurdie-Hillfield silt loams, 10 to 30 percent slopes, eroded (MdE2).—This complex consists of strongly undulating and rolling soils on high lake terrace escarpments east of the town of Paradise. About 60 percent of the complex is McMurdie silt loam, 10 to 20 percent slopes, and about 40 percent is Hillfield silt loam, 20 to 30 percent slopes, eroded. Runoff is rapid, and the hazard of erosion is high.

The McMurdie soil is on north-facing slopes or the lower part of south-facing slopes and in swales. It is similar to McMurdie silt loam, 3 to 6 percent slopes, except that it is more strongly sloping, it is moderately eroded, and the surface layer is 7 to 8 inches thick. In places tillage has exposed the subsoil.

The Hillfield soil is on convex ridges and the upper part of south-facing slopes.

Soils of this mapping unit are used for dryfarmed crops of alfalfa and winter wheat. (McMurdie soil is in capability unit IVe–M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3. Hillfield soil is in capability unit VIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Mendon Series

The Mendon series consists of well-drained soils that have a clay loam subsoil. These soils formed in alluvium and colluvium derived from light-colored tuff, conglomerate, tuffaceous sandstone, and limestone of the Salt Lake Formation. They are on lake terraces or rolling dissected foothills along the west side of Cache Valley and extend from the vicinity of Clarkston southward to Hyrum Reservoir. Elevations range from 4,500 to 5,100 feet, and slopes range from 0 to 20 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, balsamroot, and big sagebrush. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 150 days. Mendon soils are associated with Avon (fig. 6), Collinston, Wheelon, and Crookston soils.

In a representative profile (fig. 7), the surface layer is dark-gray, neutral silt loam about 7 inches thick. The subsoil is grayish-brown, neutral clay loam about 21 inches thick. The substratum is white and light brownish-gray, strongly calcareous, mildly alkaline loam to a depth of 60 inches or more.

Mendon soils are used mostly for dryfarming, but some areas are used for irrigated crops.

Mendon silt loam, 3 to 6 percent slopes (MeB).—This soil is on the gently undulating intermediate lake terraces. It is mainly along the west side of Cache Valley but also is on the east side between the towns of Richmond and Smithfield.

Representative profile, about 2 miles north and 1 mile west of Newton, 700 feet north and 40 feet west of the southeast corner of the southwest quarter of sec. 1, T. 13 N., R. 2 W.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; mixed weak, medium, subangular blocky and weak, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; few fine roots; few fine pores; neutral; abrupt, smooth boundary.

B2t—7 to 24 inches, grayish-brown (10YR 5/2) clay loam, very dark gray (10YR 3/1) when moist; moderate, medium, prismatic structure that parts to moderate,

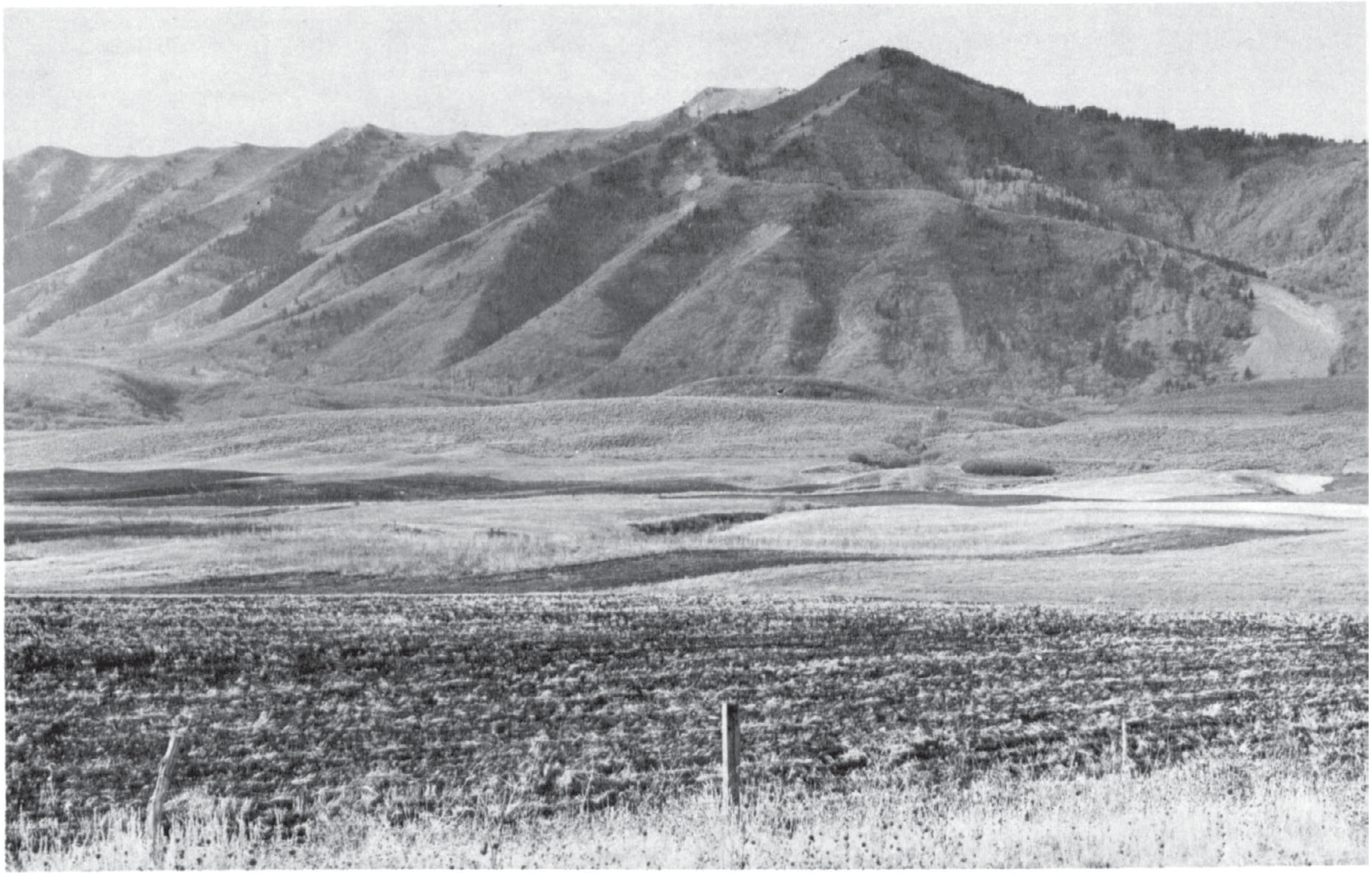

Figure 6.—Area of Mendon and Avon soils west of Mendon Cemetery. Collinston, Mendon, and Hiibner soils are on the upper lake terraces in the background, and Smarts and Lucky Star soils are dominant on the mountain.

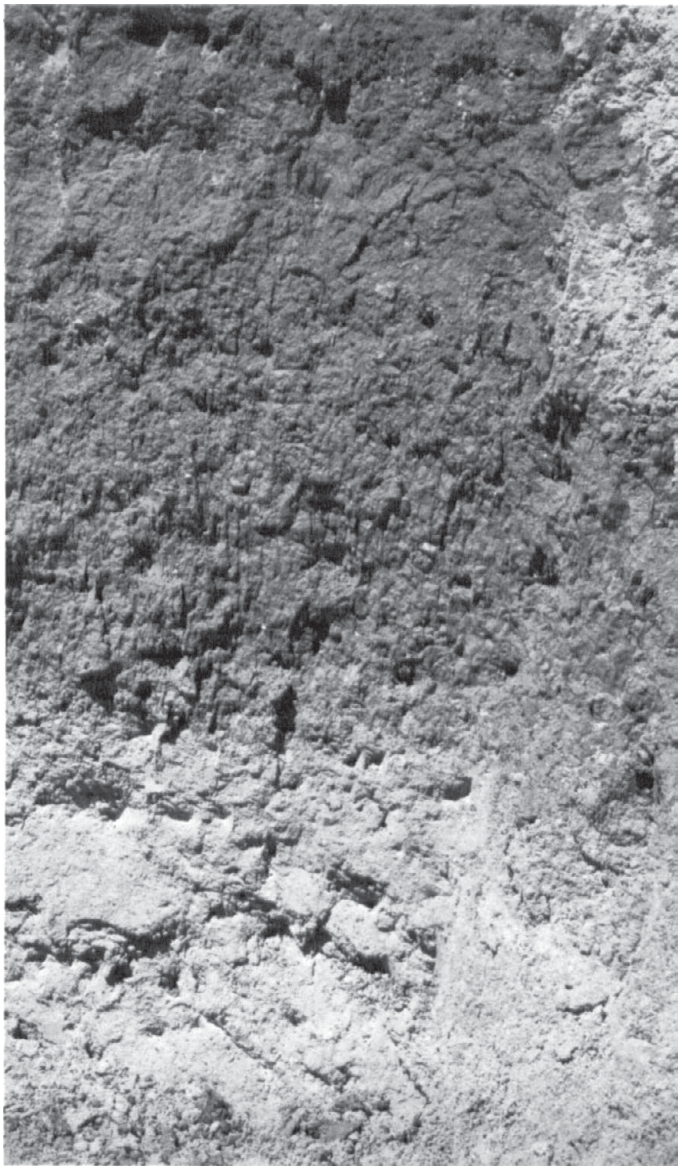

Figure 7.—**Profile of Mendon silt loam, 3 to 6 percent slopes.**

medium, subangular blocky structure; very hard, very firm, very sticky and plastic; common fine roots; many fine pores; common thin clay films; neutral; clear, smooth boundary.

B3ca—24 to 28 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; very hard, friable, sticky and plastic; common fine roots; few fine pores; few thin clay films; strongly calcareous; mildly alkaline; gradual, wavy boundary.

C1ca—28 to 34 inches, white (10YR 8/2) loam, pale brown (10 YR 6/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many fine and medium pores; very strongly calcareous; mildly alkaline; gradual, wavy boundary.

C2—34 to 40 inches, light brownish-gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many fine, medium, and large pores; strongly calcareous; mildly alkaline; gradual, wavy boundary.

C3—40 to 60 inches, white (2.5Y 8/2) loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; no roots; common fine and medium pores; strongly calcareous; mildly alkaline.

The A horizon ranges from dark gray to very dark gray in a hue of 10YR or 2.5Y. Texture is dominantly silt loam but is light silty loam in places. Reaction is neutral to mildly alkaline, and the horizon generally is noncalcareous but is slightly calcareous in places because of recent deposition or rodent activity. Thickness ranges from 7 to 11 inches. The B2t horizon ranges from grayish brown to gray or dark grayish brown in a hue of 10YR or 2.5Y. Texture is clay loam to silty clay loam. Reaction is neutral to mildly alkaline. Thickness ranges from 8 to 18 inches. The C horizon ranges from white to light brownish gray or pale brown in a hue of 2.5Y or 10YR. Texture ranges from silt loam or loam to silty clay loam.

This soil is easy to till. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet.

Included in mapping were small areas of Collinston silt loam, 1 to 6 percent slopes, and small areas of Wheelon silt loam. Also included were few small areas of gravelly loam on ridges, particularly in the Newton and North Clarkston area.

This soil is used mainly for dryfarmed crops of alfalfa, winter wheat, and safflower. Small areas are irrigated. Alfalfa, small grain, and sugar beets are grown. (Capability unit IIe-2, irrigated, IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Mendon silt loam, 0 to 3 percent slopes (MeA).—This slightly undulating soil is on medium lake terraces. Except for slope, it is similar to Mendon silt loam, 3 to 6 percent slopes. The surface layer is 10 to 17 inches thick. Runoff is slow, and the hazard of erosion is slight.

This soil is used mainly for dryfarmed crops of alfalfa, winter wheat, and safflower. Small areas are irrigated. Sugar beets, alfalfa, and small grain are grown in these areas. (Capability unit IIc-2, irrigated; IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Mendon silt loam, 6 to 10 percent slopes (MeC).—This soil is on medium and high terraces. It is similar to Mendon silt loam, 3 to 6 percent slopes, except that it is more sloping and its surface layer is 7 to 10 inches thick. In places tillage has exposed the subsoil. Strong lime horizons are present at a depth of 20 to 24 inches. Runoff is medium, and the hazard of erosion is moderate. Most runoff is during intense thunderstorms or when snow melts exceptionally fast.

Included in mapping were small areas of Wheelon silt loam and small areas of gravelly soils.

This soil is used mostly for dryfarmed crops of alfalfa, alfalfa-grass mixture, winter wheat, and safflower. Small areas are sprinkler irrigated. (Capability unit IIIe-2, irrigated; IIIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Mendon-Collinston complex, 1 to 6 percent slopes (MfB).—This complex consists of strongly undulating soils on medium and high lake terraces along the west side of Cache Valley. About 45 percent of the complex is Mendon silt loam, 3 to 6 percent slopes; 45 percent is **Collins-**

ton loam, 1 to 6 percent slopes; and about 10 percent is included soils.

The Mendon soil is more gently sloping than the Collinston soil and commonly has slopes that face north. It is similar to Mendon silt loam, 3 to 6 percent slopes, except that the surface layer is 6 to 17 inches thick and is slightly calcareous in places. It is calcareous because of the deposition of calcareous material eroded from adjacent Collinston and Wheelon soils.

The Collinston soil has south- and east-facing slopes.

Included in mapping were areas of Wheelon silt loam that are on convex ridges and the steeper slopes of the complex. Also included were small areas of soils that have slopes of 6 to 15 percent and small gravelly areas that are associated with the Wheelon soil on the ridgetops.

Soils of this mapping unit are used for dryfarmed crops. Winter wheat (fig. 8) and alfalfa are common crops. (Capability unit IIIe-U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Mendon-Collinston complex, 6 to 30 percent slopes, eroded (MfE2).—This complex consists of strongly undulating or rolling soils on high lake terraces along the west side of Cache Valley. About 40 percent of the complex is Mendon silt loam, 6 to 10 percent slopes; 40 percent is Collinston loam, 10 to 30 percent slopes, eroded; and 20 percent is Wheelon silt loam, 10 to 30 percent slopes, eroded.

The Mendon soil generally is at the base of north-facing slopes and in depressions. It is similar to Mendon silt loam, 3 to 6 percent slopes, except that it is more sloping and its surface layer is slightly calcareous in places.

The Collinston soil generally is on moderately steep south-facing slopes and the upper part of north-facing slopes. It is similar to Collinston loam, 6 to 10 percent slopes, described under the Collinston series, except that it is steeper and is moderately eroded.

The Wheelon soil is on moderately steep, convex slopes and ridgetops.

Included in mapping were areas of soils that have a silty clay loam surface layer.

Soils of this mapping unit are used mostly for dryfarmed crops of winter wheat, alfalfa, and safflower. (Capability unit VIe-U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

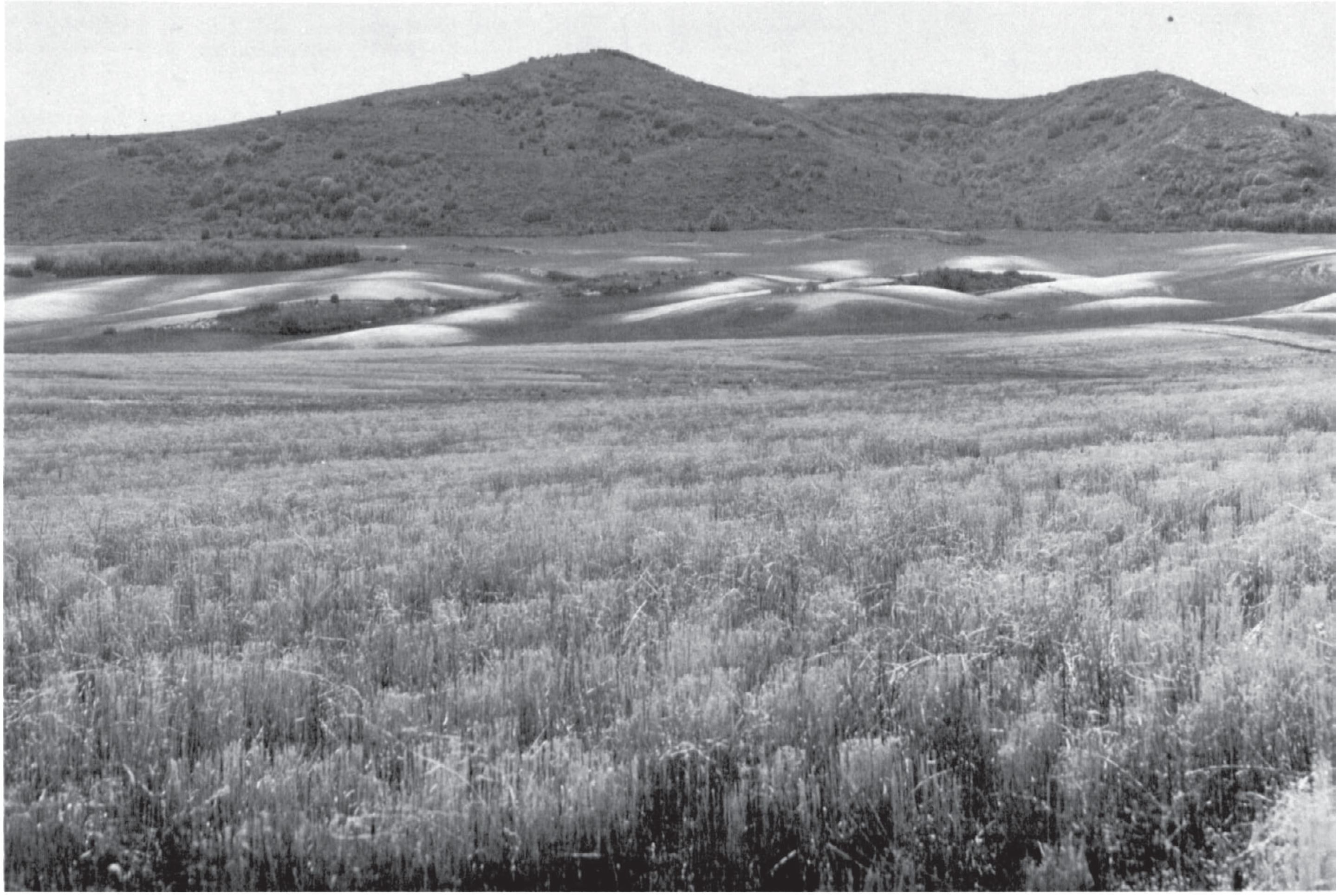

Figure 8.—Wheat stubble on the Mendon soil of the Mendon-Collinston complex, 1 to 6 percent slopes. Soils of the Mendon-Collinston complex, 6 to 30 percent slopes, eroded, are on the high lake terraces in the background.

Middle Series

The Middle series consists of well-drained, cobbly soils. The depth to bedrock ranges from 24 to 40 inches. These soils formed in residuum and colluvium derived from limestone, quartzite, and sandstone. They are on west- and south-facing mountain slopes at elevations of 5,000 to 6,500 feet. The slopes range from 30 to 70 percent. The vegetation is big sagebrush, low sagebrush, yellowbrush, bitterbrush, slender wheatgrass, bluebunch wheatgrass, prairie junegrass, and scattered juniper. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 110 to 130 days. Middle soils are associated with Richmond soils.

In a representative profile, the surface layer is grayish-brown, mildly alkaline cobbly light loam about 7 inches thick. The subsoil is brown and light yellowish-brown, mildly alkaline and moderately alkaline cobbly loam and very cobbly loam about 13 inches thick. The substratum is pink and light-brown, moderately alkaline very cobbly heavy sandy loam about 8 inches thick over limestone bedrock.

Representative profile of Middle cobbly loam, 30 to 70 percent slopes, in an area of Richmond-Middle association, eroded, in Box Elder County, on the west face of Wellsville Mountain, Cache National Forest, in the northeast quarter of the southwest quarter of the northeast quarter of sec. 9, T. 11 N., R. 2 W.:

A1—0 to 7 inches, grayish-brown (10YR 5/2) cobbly light loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure that parts to weak, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many micro and very fine roots and common fine roots; 30 percent channery limestone, cobblestones 3 to 6 inches in length; mildly alkaline; clear, wavy boundary.

B21—7 to 15 inches, brown (10YR 5/3) cobbly loam, dark brown to brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure that parts to moderate, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few thin clay films; common fine and very fine roots; few very fine pores; 40 percent angular cobblestones and 10 percent angular gravel; slightly calcareous; mildly alkaline; clear, wavy boundary.

B22—15 to 20 inches, light yellowish-brown (10YR 6/4) very cobbly loam, dark brown to brown (10YR 4/3) when moist; moderate, coarse, subangular blocky structure that parts to moderate, medium and fine, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common thin clay films on ped faces and in pores; 50 percent angular gravel; moderately calcareous; moderately alkaline; abrupt, wavy boundary.

Cca—20 to 28 inches, pink and light-brown (7.5YR 7/4 and 6/4) very cobbly heavy sandy loam, strong brown (7.5YR 4/6) when moist; weak, fine, subangular blocky structure that parts to weak, very fine, subangular blocky structure and single grain; slightly hard, very friable, nonsticky and nonplastic; few fine roots; 60 percent angular cobblestones; strongly calcareous; moderately alkaline.

R—28 inches, limestone rock.

The thickness of the solum and the depth to horizons of carbonate accumulation range from 16 to 28 inches. Coarse fragments range from 20 to 50 percent gravel and cobblestones in the A horizon, 40 to 80 percent cobblestones, gravel, and stones in the B2t horizon, and 50 to 90 percent cobblestones and stones in the C horizon. Coarse fragments are angular sandstone, limestone, and quartzite rock fragments. The A horizon ranges from grayish brown to brown. Texture is gravelly loam or cobbly loam. Reaction ranges from neutral to moderately alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness ranges from 7 to 12 inches. The B2 horizon ranges from brown to pale brown or grayish brown. Texture is very gravelly loam or cobbly loam to very cobbly loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is noncalcareous to moderately calcareous. The C horizon ranges from pink to brown or grayish brown in hues of 10YR and 7.5YR Texture ranges from very cobbly sandy loam to heavy loam. The matrix of the C horizon is moderately calcareous to strongly calcareous and has lime enrichment in the upper part. The calcium carbonate equivalent ranges from 4 to 40 percent.

Permeability is moderate. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. These soils hold 3 to 4 inches of available water above the bedrock. Roots generally extend to the bedrock, but some roots extend into cracks in the bedrock.

Middle soils are used for watershed, range, and wildlife habitat.

In the Cache Area, the Middle soils are mapped only in an association with the Richmond soils.

Millville Series

The Millville series consists of well drained and moderately well drained, very strongly calcareous soils. These soils formed in alluvium derived from dolomitic limestone. They are on alluvial fans deposited on high and medium lake terraces between the towns of Smithfield and Providence at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 6 percent. The vegetation is big sagebrush, bluebunch wheatgrass, bluegrass, cheatgrass, and gumweed. The average annual precipitation ranges from 15 to 17 inches, the mean annual temperature is 47° to 49° F., and the frost-free season is 140 to 160 days. Millville soils are associated with Green Canyon, Timpanogos, Parleys, Greenson, and Nibley soils.

In a representative profile, the surface layer is dark grayish-brown and grayish-brown silt loam about 12 inches thick. This is underlain by light brownish-gray, pale-brown, and light-gray silt loam that extends to a depth of 60 inches or more. The entire profile is moderately alkaline and very strongly calcareous.

Millville soils are used mainly for irrigated crops.

Millville silt loam, 2 to 4 percent slopes (MlB).—This soil is on alluvial fans, chiefly in the North Logan-Smithfield area.

Representative profile in a cultivated area, one-fourth mile north of the Utah State University Dairy Farm Headquarters, 40 feet north and 100 feet west of the northeast corner of the southeast quarter of sec. 22, T. 12 N., R. 1 E.:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; few medium pores; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

A12—6 to 12 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; very weak, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine roots; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

AC—12 to 24 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C1—24 to 35 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C2—35 to 65 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; very strongly calcareous; moderately alkaline.

The A1 horizon ranges from dark grayish brown to brown in a hue of 10YR. Reaction is moderately alkaline to mildly alkaline, and the horizon is strongly calcareous or very strongly calcareous. Thickness ranges from 7 to 15 inches. The C horizon ranges from pale brown to light gray or light brownish gray in a hue of 10YR or 2.5Y.

This soil is easy to till. It is well drained, and permeability is moderate. Runoff is slow, and the hazard of erosion is slight. This soil holds 8 to 10 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet or more.

Included in mapping were small areas of Green Canyon gravelly loam, 0 to 3 percent slopes, and areas of slightly steeper soils. Also included are small areas of moderately well drained Millville soils.

This soil is used mostly for irrigated crops of alfalfa, sugar beets, small grains, peas, pole beans, and corn for silage. (Capability unit IIe–2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Millville silt loam, 0 to 2 percent slopes (MlA).—This soil is similar to Millville silt loam, 2 to 4 percent slopes, except that it is more gently sloping and has a fluctuating water table between depths of 40 and 50 inches during the growing season. It is moderately well drained. Strong-brown to light olive-brown mottles are present in the lower subsoil and substratum.

Included in mapping were small gravelly areas and small areas of a silty clay loam.

This Millville soil is used for irrigated crops of alfalfa, small grain, sugar beets, peas, pole beans, and corn for silage. (Capability unit IIw–2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Mixed Alluvial Land

Mixed alluvial land (Mm) is a miscellaneous land type consisting of stratified, dominantly sandy alluvial soil material deposited along the flood plain of the Bear River, Blacksmith Fork River, and other streams. The area is characterized by many oxbows and wet spots. It is subject to overflow during periods of high runoff in spring. Little or no profile formation has taken place, but mottling is evident in the substratum. Grass, weeds, and willows are established in some places, and the area has limited use for grazing. The principal use is for wildlife habitat. (Capability unit Vw–2, nonirrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Mult Series

The Mult series consists of well-drained soils. Fractured limestone bedrock is at a depth of 22 to 40 inches. These soils formed in colluvium and residuum derived dominantly from limestone. They are on north- and east-facing mountain slopes at elevations of 6,800 to 9,500 feet. Slopes range from 6 to 50 percent. The vegetation is aspen and scattered conifers and an understory of snowberry, slender wheatgrass, mountain brome, and blue wildrye. The average annual precipitation ranges from 25 to 30 inches, the average annual air temperature is 36° to 42° F., and the frost-free season is 70 to 90 days. Mult soils are associated with Bickmore, Lucky Star, Dateman, Agassiz, and Elwood soils.

In a representative profile, the surface layer is brown, slightly acid and medium acid heavy silt loam, about 14 inches thick, that has a moderate to moderately high organic-matter content. The subsoil is yellowish-brown, medium acid silty clay loam about 10 inches thick. Fractured limestone bedrock is at a depth of about 24 inches. Carbonates have been leached from the surface layer and subsoil. The base saturation percentage ranges from 70 to 85 percent.

Mult soils are used for watershed, wildlife habitat, woodland, and range.

Mult-Agassiz association (MNE).—This mapping unit is in the upper areas of LaPlatta Creek, Davenport Creek, and South Cottonwood. The soils are on mountain slopes that have many side drainageways. The exposed rock formations are limestone. About 40 percent of the association is Mult silt loam, 6 to 30 percent slopes; 40 percent is Agassiz rocky silt loam, 6 to 30 percent slopes; and 20 percent is Elwood silt loam, 10 to 30 percent slopes.

The Multi soil is predominantly on north-facing slopes in basinlike pockets where the vegetation is aspen. The Agassiz soil is on south-, east-, and west-facing slopes of ridges. Here, the vegetation is shrubs, grass, and a few coniferous trees. The Elwood soil has north- and east-facing slopes. Depth to bedrock ranges from 22 to 40 inches. The vegetation is Douglas-fir and alpine fir.

Representative profile of Mult silt loam, 6 to 20 percent slopes, in an area of Mult-Agassiz association in South Cottonwood Canyon, 1,600 feet south and 1,200 feet east of the northwest corner of sec. 30, T. 10 N., R. 3 E.:

A11—0 to 4 inches, brown (10YR 4/3) heavy silt loam, very dark brown (10YR 2/3) when moist; moderate, fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine roots and common medium roots; slightly acid; abrupt, wavy boundary.

A12—4 to 14 inches, brown (10YR 4/3) heavy silt loam, dark brown (10YR 3/3) when moist; strong, medium and coarse, granular structure; slightly hard, friable, slightly sticky and plastic; many fine roots and common medium roots; common, very fine, discontinuous, random, inped and exped, interstitial and tubular pores; medium acid; clear, smooth boundary.

B21t—14 to 24 inches, light yellowish-brown (10YR 6/4) silty clay loam, dark brown to brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, firm, sticky and plastic; common, very fine, discontinuous, random, inped and exped, interstitial and tubular pores; common fine and medium roots; thin continuous clay films on peds and moderately thick continuous clay films in pores;

tongues of A12 material extend through this horizon; medium acid; clear, broken boundary.

R—24 inches, fractured limestone rock.

The A1 horizon ranges from brown to grayish brown in hues of 10YR and 7.5YR. Texture ranges from silt loam or loam to light silty clay loam. Thickness ranges from 8 to 16 inches. The B2t horizon ranges from yellowish brown or light brown to brown or reddish brown in hues of 10YR to 5YR. Texture ranges from silty clay loam or clay loam to heavy silt loam. Reaction ranges from medium acid to mildly alkaline. The lower part of the B2t horizon is slightly calcareous in places.

Permeability of the Mult soil is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 5 to 7 inches of available water above the bedrock. Roots are mostly in the surface 20 to 40 inches above the bedrock. Some roots extend into cracks in the bedrock.

Soils of this mapping unit are used for range, watershed, wildlife habitat, and woodland. (Mult soil is in capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Mult-Agassiz association, eroded (30 to 70 percent slopes) (MNG2).—This mapping unit is east of the Logan River in the Franklin Basin area. The soils are on southwest-facing mountain slopes that are dissected somewhat by canyons and drainages. The elevation ranges from 6,500 to 7,200 feet. About 50 percent of the association is Mult silt loam, 30 to 50 percent slopes; 45 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and about 5 percent is included soils.

The Mult soil generally has concave slopes that face east. This soil is similar to Mult silt loam, 6 to 30 percent slopes, except that it has slopes of 30 to 50 percent. The surface layer ranges from 11 to 14 inches in thickness, and the depth to bedrock ranges from 30 to 40 inches. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The vegetation is aspen.

The rocky Agassiz soil has slopes that face south and west. The vegetation is big sagebrush and curlleaf mountain-mahogany.

Included in mapping were areas of Elwood silt loam, 30 to 60 percent slopes. This soil generally has an easterly exposure. The vegetation is Douglas-fir and alpine fir.

Soils of this mapping unit are used for range, watershed, wildlife habitat, and woodland. (Mult soil is in capability unit VIIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Mult-Lucky Star association (6 to 30 percent slopes) (MSE).—This mapping unit consists of soils on mountain slopes in the upper LaPlatta Creek area. About 35 percent of the association is Mult silt loam, 6 to 30 percent slopes; 30 percent is Lucky Star silt loam, 6 to 30 percent slopes; 30 percent is Agassiz rocky silt loam, 6 to 30 percent slopes; and about 5 percent is included soils.

The Mult and Lucky Star soils are on all exposures. The vegetation is aspen. The Agassiz soil is on east-, south-, and west-facing ridges. The vegetation is sagebrush.

Soils of this mapping unit are used for range, watershed, wildlife habitat, and woodland. (Mult and Lucky Star soils are in capability unit VIe–HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Munk Series

The Munk series consists of well-drained soils that formed in light-colored tuff, tuffaceous sandstone, and limestone. Depth to bedrock is 20 to 40 inches. These soils are on mountain slopes, mainly along the west side of Cache Valley at elevations of 4,500 to 5,700 feet. Slopes range from 30 to 70 percent. The vegetation is bluebunch wheatgrass, sagebrush, yellowbrush, oyster plant, and bitterbrush. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the average frost-free season is 120 to 140 days. Munk soils are associated with Blackrock, Collinston, and Wheelon soils.

In a representative profile, the surface layer is grayish-brown, moderately alkaline gravelly loam about 8 inches thick. The next layer is light brownish-gray, moderately alkaline very gravelly loam about 15 inches thick. The substratum is white, very strongly calcareous, strongly alkaline very gravelly sandy loam that is underlain by bedrock at a depth of about 36 inches.

Munk soils are used for range, watershed, and wildlife habitat.

Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded (MoG2).—This complex is on mountain slopes along the west side of Cache Valley. About 60 percent of the complex is Munk gravelly loam, 30 to 70 percent slopes, eroded; and 40 percent is Blackrock gravelly loam, 30 to 60 percent slopes.

The Munk soil is on south- and west-facing side slopes and ridges. It is moderately eroded.

The Blackrock soil has slopes that face north and east.

Representative profile of Munk gravelly loam in an area of Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded, in a range area, approximately 600 feet south and 200 feet west of the northeast corner of the southeast quarter of sec. 7, T. 14 N., R. 1 W.:

A1—0 to 8 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots; common fine pores; 40 percent gravel; moderately calcareous; moderately alkaline; clear, smooth boundary.

AC—8 to 23 inches, light brownish-gray (10YR 6/2) very gravelly loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; common fine pores; 50 percent gravel; strongly calcareous; moderately alkaline; abrupt, smooth boundary.

Cca—23 to 36 inches, white (10YR 8/2) very gravelly sandy loam, light brownish gray (10YR 6/2) when moist; massive; soft, very friable, nonsticky and nonplastic;

few fine roots; approximately 50 to 60 percent gravel; very strongly calcareous; strongly alkaline; abrupt, smooth boundary.

R—36 inches, partially consolidated bedrock (Salt Lake Geologic Formation material).

The A1 horizon ranges from grayish brown to brown, dark brown, or light olive brown in a hue of 10YR or 2.5Y. Texture is gravelly loam to gravelly silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. Thickness ranges from 7 to 10 inches. The transitional AC horizon ranges from light brownish gray to brown, pale brown, or light yellowish brown in a hue of 10YR or 2.5Y. Texture is very gravelly loam to gravelly loam or very gravelly silt loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is strongly calcareous to moderately calcareous. Thickness ranges from 6 to 15 inches. The Cca and C horizons range from white to light yellowish-brown in hues of 10YR and 2.5Y. Texture ranges from very gravelly sandy loam to very gravelly loam. Reaction is moderately alkaline to strongly alkaline, and the horizon is strongly calcareous to very strongly calcareous. In places 10 percent cobblestones are on the surface and throughout the profile. The depth to bedrock ranges from 20 to 40 inches. In places the ca horizon is weakly to moderately cemented. Coarse fragments are mostly gravel- and cobblestone-size, rounded to slightly angular limestone rock fragments and range in volume from 20 to 50 percent in the A1 horizon and from 50 to 70 percent in the Cca and C horizons.

Permeability is moderate. Runoff is rapid or very rapid, and the hazard of erosion is high to very high. The available water holding capacity is 2 to 4 inches above bedrock.

Included in mapping were a few areas of deep and moderately deep, light-colored loamy soils and small areas of limestone rock outcrops.

These soils are used for range. Erosion control and proper range use are the principal management needs. (Munk soil is in capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2. Blackrock soil is in capability unit VIIs–U4; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Nebeker Series

The Nebeker series consists of well-drained soils that have a clay subsoil. These soils formed in noncalcareous alluvium derived from sandstone, quartzite, and shale. They are on coalescing alluvial fans at elevations of 5,100 to 5,700 feet. Slopes range from 3 to 40 percent. The vegetation is slender wheatgrass, western wheatgrass, big sagebrush, bitterbrush, and mulesear dock. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 110 to 140 days. Nebeker soils are associated with McMurdie, Hiibner, Parleys, Richmond, and Hendricks soils.

In a representative profile, the surface layer is dark grayish-brown, slightly acid silt loam, about 8 inches thick, that has a moderately high organic-matter content. The subsoil is brown, slightly acid silt loam and silty clay loam about 47 inches thick. The substratum is brown, mildly alkaline clay loam to a depth of 60 inches or more.

Nebeker soils are used for dryfarmed crops, irrigated crops, and range.

Nebeker silt loam, 10 to 25 percent slopes (NbE).—This soil is on old fans just above the highest level of ancient Lake Bonneville.

Representative profile in a cultivated area, 1 mile north and 1½ miles east of Paradise, 20 feet north and 100 feet west of the southeast corner of the southwest quarter of sec. 14, T. 10 N., R. 1 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores and common medium pores; slightly acid; clear, wavy boundary.

B1—8 to 14 inches, brown (7.5YR 5/3) heavy silt loam, dark brown (7.5YR 3/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; hard, firm, sticky and plastic; common fine roots; common fine pores and few medium pores; few thin clay films; medium acid; clear, wavy boundary.

B21t—14 to 26 inches, brown (7.5YR 5/3) silty clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, sticky and plastic; few fine roots; common fine pores; common thin clay films; slightly acid; abrupt, smooth boundary.

B22t—26 to 48 inches, brown (7.5YR 5/4) clay, reddish brown (5YR 4/3) when moist; strong, coarse, prismatic structure that parts to strong, coarse, subangular blocky structure; extremely firm, very sticky and very plastic; few fine roots; few fine pores; many thin clay films; slightly acid; clear, smooth boundary.

B23t—48 to 55 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, sticky and plastic; common fine pores; many moderately thick clay films; neutral; clear, smooth boundary.

IIC—55 to 70 inches, brown (10YR 5/3) clay loam, dark brown to brown (10YR 4/3) when moist; massive; slightly hard, firm, slightly sticky and plastic; slightly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to brown in a hue of 10YR or 7.5YR. Texture ranges from silt loam to light silty clay loam. Reaction ranges from medium acid to neutral. Thickness ranges from 3 to 10 inches. The B1 horizon ranges from brown to dark grayish brown in a hue of 7.5YR or 10YR. Texture ranges from heavy silt loam to silty clay loam. Reaction ranges from medium acid to neutral. Thickness ranges from 4 to 8 inches. The B2t horizon ranges from brown to reddish brown or light brown in a hue of 7.5YR or 5YR. Texture ranges from heavy clay loam or heavy silty clay loam to clay or silty clay. Reaction is slightly acid to neutral. Thickness ranges from 30 to 50 inches. The C horizon ranges from brown to yellowish brown or light brown in hues of 7.5YR and 10YR. Texture ranges from clay loam to light clay. Reaction is neutral to mildly alkaline, and the horizon is slightly calcareous to moderately calcareous.

Included in mapping were small areas of Hendricks silt loam, 10 to 20 percent slopes, and small areas of Sterling gravelly loam, 10 to 20 percent slopes. Also included were small areas of soils that have slopes of 25 to 30 percent.

This soil is fairly easy to till. Permeability is moderately slow. Runoff is medium, and the hazard of erosion is moderate. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Plant roots penetrate to a depth of 5 feet or more.

This soil is used mostly for dryfarmed crops. Principal crops are alfalfa and winter wheat. (Capability unit IVe–

M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Nebeker silt loam, 3 to 6 percent slopes (NbB).—This soil is on the lower part of old alluvial fans. Except for its more gentle slopes, it is similar to Nebeker silt loam, 10 to 25 percent slopes. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used mostly for dryfarmed crops, but some areas are irrigated. The crops are small grain and alfalfa. (Capability unit IIe-2, irrigated, IIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Nebeker silt loam, 6 to 10 percent slopes (NbC).—This soil is on fans. Except that it is less sloping, it is similar to Nebeker silt loam, 10 to 25 percent slopes. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Sterling gravelly loam, 6 to 10 percent slopes, and a few small areas of soils that have slopes of 10 to 20 percent.

This soil is used mostly for dryfarmed crops, but some areas are irrigated. Principal crops are alfalfa and small grain. (Capability unit IIIe-2, irrigated, IIIe-M, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 3)

Nibley Series

The Nibley series consists of somewhat poorly drained soils that formed in mixed lake sediment derived from limestone, sandstone, and quartzite. These soils are on medium and low lake terraces at elevations of 4,450 to 4,700 feet. Slopes range from 0 to 6 percent. The vegetation is foxtail, saltgrass, Kentucky bluegrass, wiregrass, and sedges. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 150 days. Nibley soils are associated with Collett, Greenson, Airport, and Parleys soils.

In a representative profile, the surface layer is dark grayish-brown, mildly alkaline heavy silty clay loam about 13 inches thick. The subsoil is brown and light-gray, mildly alkaline to moderately alkaline silty clay in the upper part and light-gray, strongly alkaline silty clay in the lower part. It is about 30 inches thick. The substratum is light-gray, moderately to strongly alkaline, strongly calcareous silty clay to a depth of 60 inches or more.

Nibley soils are used for irrigated crops and range.

Nibley silty clay loam, 0 to 3 percent slopes (NcA).—This soil is on broad, low lake terraces, generally east of College Ward and north of Hyrum.

Representative profile in a cultivated area, 1/8 mile south and 5/8 mile east of the Utah State University Animal Husbandry Farm Headquarters, 500 feet north and 300 feet east of the southwest corner of the northeast quarter of sec. 30, T. 11 N., R. 1 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) heavy silty clay loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; hard, firm, sticky and plastic; common fine roots and few medium roots; few fine pores; noncalcareous; mildly alkaline; abrupt, smooth boundary.

A1—7 to 13 inches, dark grayish-brown (10YR 4/2) heavy silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; hard, firm, sticky and plastic; common fine roots and few medium roots; common fine pores; noncalcareous; mildly alkaline; abrupt, smooth boundary.

B21t—13 to 20 inches, brown (10YR 5/3) silty clay, brown to dark brown (7.5YR 4/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; very hard, very firm, sticky and very plastic; common fine roots; common fine pores and few medium pores; common thin clay films; slightly calcareous; mildly alkaline; gradual, wavy boundary.

B22tca—20 to 32 inches, light-gray (10YR 7/2) silty clay, grayish brown (10YR 5/2) when moist; few, fine, distinct, strong brown (7.5YR 5/8) mottles; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; very hard, very firm, sticky and very plastic; few fine roots; many fine pores and few medium pores; few thin clay films; strongly calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—32 to 43 inches, light-gray (10YR 7/2) silty clay, pale brown (10YR 6/3) when moist; common, medium distinct, strong-brown (7.5YR 5/8) mottles; weak, medium, prismatic structure that parts to moderate, fine, subangular blocky structure; very hard, very firm, sticky and very plastic; few fine roots; many fine pores and few medium pores; strongly calcareous; strongly alkaline; clear, smooth boundary.

C—43 to 60 inches, light-gray (2.5Y 7/2) silty clay, light brownish gray (2.5Y 6/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; very hard, very firm, sticky and very plastic; common fine pores; strongly calcareous; moderately alkaline.

The A horizon ranges from dark grayish brown to grayish brown. Texture ranges from silty clay loam to heavy silt loam. Reaction is neutral to mildly alkaline. Thickness ranges from 6 to 15 inches. The B2t horizon ranges from brown to grayish brown in a hue of 10YR or 7.5YR. Texture ranges from heavy silty clay loam to silty clay. Reaction ranges from neutral to moderately alkaline. The B2tca and B3ca horizons range from light gray to light brown or very pale brown in hues of 10YR and 7.5YR. Texture ranges from silty clay to heavy silty clay loam. Reaction is moderately alkaline to strong alkaline. The C horizon ranges from light gray to white or very pale grown in a hue of 2.5Y, 10YR, or 7.5YR. Texture ranges from silt loam to silty clay. Reaction is moderately alkaline to strongly alkaline. The depth to the water table generally is 30 to 40 inches in undrained areas and is 50 inches to more than 60 inches in drained areas.

The soil is fairly difficult to till. Permeability is slow. Runoff is very slow to slow, and the hazard of erosion is none to slight. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Most plant roots are within a depth of 20 inches, but some penetrate to a depth of more than 5 feet.

Included in mapping were small areas of soils that are slightly affected by salt and alkali. Also included are a few small areas of Greenson loam, 0 to 3 percent slopes, and Collett silty clay loam.

This soil is mostly drained. It is used mainly for irrigated crops of alfalfa, small grain (fig. 9), sugar beets, and corn for silage. Some areas are in native pasture. (Capability unit IIIw-2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Nibley silty clay loam, 3 to 6 percent slopes (NcB).—This soil is in narrow bands and generally is at slightly higher elevations than Nibley silty clay loam, 0 to 3 percent slopes. Slopes are short. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Figure 9.—**Barley growing on Nibley silty clay loam, 0 to 3 percent slopes. Wasatch Mountains are in the background.**

Included in mapping were small areas of gravelly loam soils and small areas of Greenson loam, 3 to 6 percent slopes.

This soil is used for irrigated crops of alfalfa, small grain, and sugar beets. (Capability unit IIIw–2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 1)

Obray Series

The Obray series consists of well-drained soils that formed in mixed colluvium and alluvium derived from limestone, quartzite, and sandstone. These soils are on alluvial and colluvial fans at elevations of 5,000 to 7,000 feet. Slopes range from 1 to 20 percent. The vegetation is Idaho fescue, slender wheatgrass, prairie junegrass, Great Basin wildrye, mulesear dock, yarrow, low sagebrush, and snowberry. The average annual precipitation ranges from 18 to 25 inches, the mean annual air temperature is 42° to 45° F., and the frost-free season is 60 to 100 days. Obray soils are associated with Nebeker, Goring, Hiibner, and Yeates Hollow soils.

In a representative profile, the soil is dark grayish-brown to pale-brown, slightly acid to mildly alkaline silty clay that extends to a depth of 60 inches or more.

Obray soils are used mostly as range. Some small areas are used for dryfarmed crops of alfalfa and small grain.

Obray silty clay, 1 to 6 percent slopes (ObB).—This soil is on the foot slopes of mountains in an area south of East Canyon and southeast of the town of Avon.

Representative profile in a cultivated area, about 4 miles south and 1 mile east of Avon, 900 feet west of the southeast corner of the northwest quarter of sec. 25, T. 9 N., R. 1 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine and medium, granular structure; very hard, firm, sticky and very plastic; few medium and fine roots; common fine pores; slightly acid; clear, smooth boundary.

A11—7 to 22 inches, brown to dark-brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium and fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores; common slickensides; slightly acid; gradual, wavy boundary.

A12—22 to 32 inches, brown (7.5YR 5/3) silty clay, dark brown (7.5YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores; common slickensides; neutral; clear, irregular boundary.

C1—32 to 39 inches, brown (7.5YR 5/4) silty clay, dark brown (7.5YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores; common slickensides; slightly calcareous; neutral; gradual, irregular boundary.

C2ca—39 to 52 inches, brown (7.5YR 5/4) silty clay, brown (7.5YR 5/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, very firm, sticky and very plastic; moderately calcareous; mildly alkaline; gradual, irregular boundary.

C3ca—52 to 60 inches, very pale brown (10YR 7/3) heavy silty clay loam, light yellowish brown (10YR 6/4) when moist; massive; hard, firm, sticky and plastic; strongly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to brown or dark brown. Reaction is slightly acid to medium acid. Slickensides are common to many. The C horizon ranges from brown to light brown or very pale brown. Texture ranges from silty clay or clay, to heavy silty clay loam or clay loam. Reaction ranges from medium acid to mildly alkaline, and the horizon is noncalcareous to strongly calcareous. The upper 30 inches of the profile is noncalcareous, but at depths between 30 to 65 inches, it ranges from noncalcareous to moderately calcareous. If the soils are dry, cracks ½ inch to 2 inches wide extend to a depth of 40 inches or more. In uncultivated areas, gilgai microrelief is evident.

Permeability is very slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil holds 9 to 11 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 3 to 4 feet.

Included in mapping were small areas of stony silty clay soils on steep escarpments.

This soil is used for range. (Capability unit VIe–M5, nonirrigated; Mountain Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Parleys Series

The Parleys series consists of well-drained soils that have a clay loam subsoil. These soils formed in mixed lake sediment derived from limestone, sandstone, and quartzite. They are on medium and high lake terraces at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 10 percent. The vegetation is bluebunch wheatgrass, big sagebrush, gumweed, and balsamroot. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 120 to 160 days. Parleys soils are associated with Timpanogos, McMurdie, Battle Creek, and Hillfield soils.

In a representative profile, the surface layer is dark grayish-brown, neutral silt loam about 8 inches thick. The subsoil is neutral, dark grayish-brown loam, brown clay loam, and pale-brown silt loam about 28 inches thick. The substratum is light-brown, mildly alkaline, strongly calcareous silt loam to a depth of 60 inches or more.

Parleys soils are used for dryfarmed and irrigated crops.

Parleys silt loam, 0 to 3 percent slopes (PaA).—This level to slightly undulating soil is on slightly convex, medium and high lake terraces.

Representative profile in a cultivated area, 1½ miles south and 1¾ miles east of the city of Hyrum, 100 feet north and 900 feet west of the southeast corner of the northeast quarter of sec. 15, T. 10 N., R. 1 E.:

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, fine and medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; neutral; abrupt, smooth boundary.

B1—8 to 12 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure that parts to moderate, fine, angular blocky structure; very hard, firm, slightly sticky and plastic; common fine roots; common fine pores; thin patchy clay films, neutral; clear, wavy boundary.

B21t—12 to 19 inches, brown (7.5YR 5/4) clay loam, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, slightly sticky and plastic; common fine roots; many fine pores; thin continuous clay films; neutral; distinct, smooth boundary.

B22t—19 to 31 inches, brown (7.5YR 5/3) clay loam, dark brown (7.5YR 4/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; hard, firm, slightly sticky and plastic; few fine roots; many fine pores; thin continuous clay films; neutral; distinct, smooth boundary.

B3ca—31 to 36 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; many fine pores and few medium pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C1ca—36 to 52 inches, light-brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine pores; strongly calcareous; mildly alkaline.

C2ca—52 to 68 inches, light-brown (7.5YR 6/4) silt loam, yellowish brown (10YR 5/4) when moist; few, medium, faint, strong-brown (7.5YR 5/6) mottles; massive; soft, very friable, slightly sticky and slightly plastic; strongly calcareous; mildly alkaline.

The A horizon ranges from dark grayish brown to grayish brown. Texture ranges from silt loam to loam or light silty clay loam. Reaction is neutral to mildly alkaline. Thickness ranges from 7 to 18 inches. The B2t horizon ranges from brown to yellowish brown in a hue of 10YR or 7.5YR. Texture is silty clay loam to clay loam. The Cca and C horizons range from light brown to very pale brown or pale brown in a hue of 10YR or 7.5YR. Texture ranges from silt loam or loam to silty clay loam. Reaction is mildly alkaline to moderately alkaline.

This soil is easy to till. Permeability is moderately slow. Runoff is slow, and the hazard of erosion is none to slight. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more.

Included in mapping were small areas of Timpanogos silt loam, 0 to 3 percent slopes, and small areas of moderately well drained Parleys soils.

This soil is used for irrigated crops. Principal crops are alfalfa, small grain, sugar beets, peas, beans, and corn for silage. About 20 percent of the acreage is used for dryfarmed crops of alfalfa and small grain. (Capability unit IIc–2, irrigated, IIIe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parleys silt loam, 3 to 6 percent slopes (PaB).—This soil generally is on high lake terraces along the east side of Cache Valley, extending from Smithfield south to Paradise. Except for slope, it is similar to Parleys silt loam, 0 to 3 percent slopes. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Hillfield silt loam, 20 to 30 percent slopes, eroded.

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This Parleys soil is used for irrigated crops of alfalfa, small grain, sugar beets, peas, and beans. (Capability unit IIe-2, irrigated, IIIe-U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parleys silt loam, 6 to 10 percent slopes (PaC).—This soil is on high lake terraces along the east-central part of Cache Valley. Except that it is more sloping, it is similar to Parleys silt loam, 0 to 3 percent slopes. The surface layer is 7 to 12 inches thick. Depth to the strongly calcareous substratum is about 24 inches. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were a few small areas of a Parleys silt loam that has slopes of slightly more than 10 percent. Also included were small areas of Hillfield silt loam, 20 to 30 percent slopes, eroded.

This Parleys soil is used mainly for dryfarmed crops of alfalfa, alfalfa and grass mixtures, and small grain. (Capability unit IIIe-2, irrigated, IIIe-UE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parlo Series

The Parlo series consists of well-drained soils that formed in mixed lake sediment derived from limestone, standstone, and quartzite. These soils are on medium and high lake terraces at elevations of 4,500 to 5,100 feet. Slopes range from 0 to 10 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, big sagebrush, gumweed, and balsamroot. The average annual precipitation ranges from 14 to 20 inches, the mean annual air temperature is 45° to 52° F., and the frost-free season is 110 to 150 days. Parlo soils are associated with Timpanogos, Nibley, Parleys, and Hillfield soils.

In a representative profile, the surface layer is dark grayish-brown, mildly alkaline silt loam about 11 inches thick. The subsoil is grayish-brown to brown, mildly alkaline silty clay loam about 10 inches thick. The substratum is pale-brown or light-brown, moderately alkaline, moderately calcareous loam and very gravelly loamy sand to a depth of 60 inches or more.

Parlo soils are used for dryfarmed and irrigated crops.

Parlo silt loam, 0 to 3 percent slopes (PlA).—This soil is on medium lake terraces, mainly in an area between the towns of Providence and Paradise.

Representative profile in a cultivated area, 2 miles north and ¼ mile west of Paradise church, 300 feet west of the road, 200 feet west and 200 feet south of the northwest corner of the northeast quarter of sec. 21, T. 10 N., R. 1 E.:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; mildly alkaline; abrupt, smooth boundary.

A1—7 to 11 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few fine pores; mildly alkaline; clear, smooth boundary.

B21t—11 to 15 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many fine pores; thin continuous clay films; mildly alkaline; gradual, wavy boundary.

B22t—15 to 21 inches, brown (10YR 5/3) silty clay loam, dark brown to brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; many fine pores; thin continuous clay films; mildly alkaline; clear, wavy boundary.

C1ca—21 to 30 inches, pale-brown (10YR 6/3) loam, brown to dark brown (10YR 4/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; many fine roots; many fine pores and few medium pores; strongly calcareous; moderately alkaline; clear, smooth boundary.

IIC2—30 to 60 inches, pale-brown (10YR 6/3) very gravelly loamy sand, brown to dark brown (10YR 4/3) when moist; single grain; loose, moist and dry, nonsticky and nonplastic; common fine roots; moderately calcareous; moderately alkaline.

The A horizon ranges from 7 to 11 inches in thickness. In places the A and B horizons contain a minor amount of gravel. Depth to the very gravelly sand IIC horizon is 28 to 40 inches. The amount of gravel ranges from 30 to 70 percent and generally increases with depth.

This soil is easy to till. It is moderately permeable. Runoff is slow, and the hazard of erosion is none to slight. This soil holds 6 to 7.5 inches of available water to a depth of 5 feet, depending on the depth to gravel. Plant roots easily penetrate to the gravelly substratum.

Included in mapping were areas of deep loamy soils and small areas of gravelly loam soils.

This soil is used mostly for irrigated crops of alfalfa, small grain, sugar beets, peas, and corn for silage, and for pasture. About 25 percent of the acreage is used for dryfarmed crops. Winter wheat and alfalfa are the principal dryfarmed crops. (Capability unit IIc-2, irrigated, IIIs-U4, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parlo silt loam, 3 to 6 percent slopes (PlB).—This soil is associated with and, except for slope, is similar to Parlo silt loam, 0 to 3 percent slopes. The surface layer is 7 to 9 inches thick. Depth to underlying gravel and sand is 24 to 40 inches. Runoff is slow, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Timpanogos silt loam, 3 to 6 percent slopes, areas of deep loamy soils, and a few small areas of soils that have a gravelly loam surface layer.

This soil is used mainly for dryfarmed crops of winter wheat and alfalfa. Small areas are used for irrigated wheat and alfalfa. (Capability unit IIe-2, irrigated, IIIs-U4, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Parlo silt loam, 6 to 10 percent slopes (PlC).—This soil is on medium and high lake terraces. It is closely associated with and is similar to Parlo silt loam, 0 to 3 percent slopes, except that it has slopes of 6 to 10 percent and its surface layer is 7 to 9 inches thick. The depth to the gravel and sand is 24 to 36 inches. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of gravelly loam soils.

This soil is used for dryfarmed crops of winter wheat and alfalfa. (Capability unit IIIe-UE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Payson Series

The Payson series consists of somewhat poorly drained, alkaline soils that have a silty clay subsoil. These soils formed in mixed lake sediment derived from limestone, sandstone, and shale rocks. They are on low lake terraces at elevations of 4,420 to 4,500 feet. Slopes range from 0 to 1 percent. The vegetation is greasewood, saltgrass, and pickleweed. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Payson soils are associated with Lewiston, Airport, and Salt Lake soils.

In a representative profile, the surface layer is light brownish-gray, mildly alkaline silt loam about 6 inches thick. The subsoil is grayish-brown or light brownish-gray, strongly alkaline silty clay about 11 inches thick. The substratum is very pale brown, very strongly alkaline, very strongly calcareous silty clay to a depth of 60 inches or more.

Payson soils are used for range.

Payson silt loam (Pn).—This soil is on the low lake terraces between the city of Logan and the town of Benson. Slopes range from 0 to 1 percent.

Representative profile, in a native pasture area near the southeast corner of Logan-Cache Airport, south of highway, 900 feet south and 1,100 feet west of the center of sec. 16, T. 12 N., R. 1 E.:

A21—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; slightly calcareous; mildly alkaline; gradual, smooth boundary.

A22—3 to 6 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium, platy structure; slightly hard, friable, sticky and plastic; many fine roots; slightly calcareous; mildly alkaline; clear, smooth boundary.

B21t—6 to 9 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; strong, coarse, columnar structure; very hard, firm, sticky and plastic; few fine roots; moderately thick continuous clay films; moderately calcareous; moderately alkaline; clear, wavy boundary.

B22tca—9 to 17 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) when moist; moderate, coarse, prismatic structure; very hard, very firm, sticky and plastic; common fine roots; common thin clay films; strongly calcareous; strongly alkaline; gradual, wavy boundary.

B3ca—17 to 21 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, very firm, sticky and plastic; strongly calcareous; very strongly alkaline; gradual, wavy boundary.

C1ca—21 to 60 inches, very pale brown (10YR 7/3) silty clay, pale brown (10YR 6/3) when moist; weak, medium, subangular blocky structure; very hard, very firm, sticky and plastic; very strongly calcareous; very strongly alkaline.

In places there is a thin A1 horizon. The A2 horizon ranges from light brownish gray to light gray or grayish brown. Texture ranges from silt loam to light silty clay loam. Reaction is mildly alkaline to moderately alkaline. Thickness ranges from 4 to 8 inches. The B2t horizon ranges from grayish brown or light brownish gray to brown or pale brown. Texture ranges from silty clay to clay or to heavy silty clay loam. The upper part of the B2t horizon has strong, medium, or coarse columnar structure, and the lower part has moderate to strong, medium, or coarse prismatic structure. Reaction ranges from moderately alkaline to very strongly alkaline. The exchangeable sodium percentage ranges from 15 to 35. The horizon is moderately to strongly calcareous. The C horizon ranges from very pale brown to white or to pale brown. Texture ranges from silty clay to silt loam. Reaction is strongly alkaline to very strongly alkaline, and the horizon is strongly calcareous or very strongly calcareous. The exchangeable sodium percentage is 20 to 95. The calcium carbonate equivalent ranges from 15 to 50 percent.

Permeability is very slow. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is 3 to 4 inches. Most roots are generally within the upper 8 to 12 inches of the profile because of the high concentration of alkali and salt in the subsoil and substratum. The water table fluctuates seasonally but generally is at a depth of 30 to 50 inches.

Included in mapping were areas of Lewiston fine sandy loam, moderately deep over clay, small areas of poorly drained soils, and areas of ponded soils.

This soil is used for range. The carrying capacity is low. (Capability unit VIIw-285, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Picayune Series

The Picayune series consists of well-drained soils that have a gravelly clay loam subsoil. These soils formed in residuum and colluvium derived from limestone and calcareous sandstone. They are on mountain slopes on all aspects, but generally are on west-facing slopes. The elevation ranges from 5,500 to 7,000 feet, and slopes range from 50 to 80 percent. The vegetation is bluebunch wheatgrass, native bluegrass, bitterbrush, big sagebrush, balsamroot, and herbaceous sage. The average annual precipitation ranges from 17 to 20 inches, the mean annual air temperature is 42° to 46° F., and the frost-free season is 80 to 100 days. Picayune soils are associated with Agassiz, Bradshaw, Sheep Creek, Richmond, and Despain soils.

In a representative profile, the surface layer is grayish-brown or brown, neutral gravelly loam about 14 inches thick. The subsoil is brown or pale-brown, mildly alkaline gravelly light clay loam about 15 inches thick. The substratum is pale-brown, strongly calcareous, strongly alkaline gravelly silt loam to a depth of 60 inches or more.

Picayune soils are used for range, watershed, and wildlife habitat.

Picayune-Agassiz association, eroded (30 to 80 percent slopes) (POG2).—This mapping unit is on south- and west-facing slopes of mountains, mostly east of Cache Valley and extending from Blacksmith Fork Canyon to East Canyon. A small area is on the Clarkston Mountains. About 65 percent of the association is Picayune gravelly loam, 50 to 80 percent slopes, eroded; 25 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and 10 percent is included soils.

The Picayune soil is on the lower part of slopes and in slightly concave areas.

The Agassiz soil is on the upper part of slopes and in convex areas. In the Clarkston Mountains, it has slightly more outcrops of rock than in other areas.

Representative profile of Picayune gravelly loam, 50 to 80 percent slopes, in an area of Picayune-Agassiz association, eroded, 500 feet northeast of the old mine south of the mouth of the Blacksmith Fork Canyon, about 200 feet north and 400 feet east of the southwest corner of sec. 12, T. 10 N., R. 1 E.:

A11—0 to 7 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and fine, granular structure; soft, friable, nonsticky and slightly plastic; many fine roots and few medium roots; 20 percent gravel; neutral; clear, wavy boundary.

A12—7 to 14 inches, brown (10YR 5/3) gravelly heavy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many fine roots and few medium roots; few, very fine and micro, continuous, random, tubular pores; 25 percent gravel; neutral; clear, wavy boundary.

B21—14 to 19 inches, brown (10YR 5/3) gravelly light clay loam, brown to dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots; few, very fine, continuous, random, tubular pores; few thin clay films in pores and on compression faces; 25 percent gravel; neutral; gradual, wavy boundary.

B22—19 to 29 inches, pale-brown (10YR 6/3) gravelly light clay loam, brown to dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; many fine roots; few, very fine, continuous, random, tubular pores; few thin clay films in pores; 25 percent gravel; very slightly calcareous, lime is nonindurated, massive and flaky; mildly alkaline; gradual, wavy boundary.

Cca—29 to 60 inches, pale-brown (10YR 6/3) gravelly silt loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; few fine roots at a depth above 48 inches; few, very fine, random, tubular pores; 40 percent gravel; very strongly calcareous, lime is nonindurated, massive and flaky; strongly alkaline.

The A1 horizon ranges from gravelly loam or cobbly loam to stony loam that is 15 to 40 percent gravel and cobblestones and is as much as 5 percent stones in places. Reaction is neutral to mildly alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness ranges from 7 to 15 inches. The B2 horizon has a hue of 10YR or 7.5YR. This horizon ranges from gravelly light clay loam to cobbly heavy loam and is 20 to 50 percent cobblestones and gravel. Reaction ranges from neutral to moderately alkaline, and the horizon is noncalcareous to moderately calcareous. Thickness ranges from 10 to 18 inches. The Cca horizon ranges from pale brown to brown or yellowish brown in a hue of 10YR or 7.5YR. This horizon ranges from gravelly silt loam or gravelly sandy loam to very gravelly or very cobbly sandy loam that is 40 to 60 percent gravel and cobblestones. Reaction is mildly alkaline to strongly alkaline, and the horizon is strongly calcareous to very strongly calcareous.

Permeability is moderate. Runoff is very rapid, and the hazard of erosion is very high. This soil holds 5 to 7.5 inches of available water to a depth of 5 feet. Roots penetrate to a depth of about 48 inches.

Included in mapping were areas of soils that are similar to the Elzinga soils.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Picayune soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 3)

Picayune-Smarts association (30 to 80 percent slopes) (PRG).—This mapping unit is on colluvial scarp slopes in drainages on Wellsville Mountain. About 40 percent of the association is Picayune cobbly loam, 50 to 80 percent slopes; 30 percent is Smarts gravelly silt loam, 30 to 70 percent slopes; 20 percent is Dateman cobbly silt loam, 40 to 70 percent slopes; 8 percent is rock outcrops; and about 2 percent is included soils.

The Picayune soil is on the upper side slopes that have a northwestern aspect. It is similar to Picayune gravelly loam, 50 to 80 percent slopes, except that it has cobblestone-size coarse fragments on the surface and throughout the profile.

The Smarts soil is on steep side slopes adjacent to drainageways. It is similar to Smarts silt loam, 10 to 30 percent slopes, except that it has slopes of 30 to 70 percent. The surface layer is 20 to 30 percent gravel and is 15 to 25 inches thick.

The Dateman soil is on north-facing slopes below ridges of rock outcrops.

Included in mapping were areas of deep alluvial soils.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Picayune soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Smarts soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 3)

Poleline Series

The Poleline series consists of well-drained soils that have a very gravelly very fine sandy loam subsoil. These soils formed in colluvium derived from sandstone. They are on slopes of mountains adjacent to drainageways at elevations of 7,000 to 9,000 feet. Slopes range from 30 to 70 percent. The vegetation is mountain-ash, willows, scrubby aspen, and mountain brome. The average annual precipitation ranges from 25 to 30 inches, the mean annual air temperature is 38° to 45° F., and the frost-free season is 70 to 90 days. Poleline soils are associated with Lucky Star, Smarts, Bickmore, and Agassiz soils.

In a representative profile, the surface layer is dark grayish-brown and brown, neutral gravelly loam about 20 inches thick. The subsoil is brown, medium acid very gravelly and cobbly light loam.

Representative profile of Poleline gravelly loam, 30 to 70 percent slopes, in an area of Smarts-Lucky Star-Poleline association, on the east face of Wellsville Mountain on Cold Spring Trail below Stewart Pass, Cache National Forest, in the southwest quarter of the northeast quarter of sec. 25, T. 11 N., R. 2 W.:

A11—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, granular structure; soft, very friable, slightly sticky and nonplastic; many fine roots; neutral; clear, wavy boundary.

A12—8 to 20 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 3/3) when moist; weak, medium and coarse, subangular blocky structure that parts to weak granular structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots and few coarse roots; slightly acid; clear, wavy boundary.

A13—20 to 32 inches, brown (10YR 5/3) very gravelly very fine sandy loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure that parts to weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and very fine roots; medium acid; abrupt, wavy boundary.

B2—32 to 60 inches, brown (10YR 5/3) very gravelly and cobbly light loam, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine roots and common medium roots; few thin clay films; medium acid; abrupt, irregular boundary.

The combined thickness of the A and B horizons ranges from 40 to more than 60 inches over the bedrock. Gravel and cobblestones are throughout the profile and gradually increase with depth. Coarse fragments are cobblestone- and gravel-size, angular or rounded sandstone and quartzite rock fragments. Their content ranges from 20 to 70 percent in the A horizon and from 40 to 80 percent in the B horizon. The A1 horizon ranges from dark grayish brown or grayish brown to brown or dark brown in hues of 10YR and 7.5YR. Texture ranges from gravelly loam, very gravelly loam, or cobbly loam to gravelly very fine sandy loam. Thickness ranges from 20 to 35 inches. The B2 horizon ranges from brown to light brown in a hue of 10YR or 7.5YR. Texture ranges from very gravelly light loam or very gravelly sandy loam to very cobbly very fine sandy loam. Reaction is slightly acid to medium acid.

Permeability is moderately rapid. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 5 to 7.5 inches of available water. Roots penetrate to a depth of 5 feet or more.

Poleline soils are used for watershed and wildlife habitat.

Poleline-Agassiz association, eroded (30 to 70 percent slopes) (PSG2).—This mapping unit is near the crest of Wellsville Mountain. About 45 percent of the association is Poleline gravelly loam, 30 to 70 percent slopes; 45 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and about 10 percent is included soils.

The Poleline soil is on very steep slopes adjacent to drainageways. The vegetation is scrubby aspen, willow, mountain-ash, and grass.

The Agassiz soil is on upper slopes and on ridges. The areas are about 20 percent rock outcrop and rock slides.

Included in mapping were areas of Elzinga silt loam, 30 to 60 percent slopes.

Soils of this mapping unit are used for watershed and wildlife habitat. (Poleline soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 3)

Preston Series

The Preston series consists of excessively drained soils that formed in wind-sorted lakeshore sediment. These soils are on rolling sand dunes at elevations of 4,470 to 4,500 feet. Slopes range from 0 to 10 percent. The vegetation is sand dropseed, Indian ricegrass, cheatgrass, and big rabbitbrush. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 46° to 48° F., and the frost-free season is 130 to 140 days. Preston soils are associated with Layton, Kidman, and Lewiston soils.

In a representative profile, the soil is dark grayish-brown to yellowish-brown, mildly alkaline fine sand to a depth of 60 inches or more.

Preston soils are used chiefly for range or are idle. Small areas are sprinkler irrigated and are used for crops of alfalfa and small grain or for pasture.

Preston fine sand, 0 to 10 percent slopes (PtC).—This soil is on rolling, partially stabilized sand dunes deposited on medium lake terraces north of the town of Cornish.

Representative profile in an uncultivated area, 2,200 feet south of the Idaho line, 1,150 feet east of State Highway No. 23, in Cornish, 700 feet north and 1,200 feet east of the southwest corner of sec. 34, T. 15 N., R. 1 W.:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) fine sand, very dark grayish brown (10YR 3/2) when moist; single grain; loose, nonsticky and nonplastic; common fine roots; noncalcareous; mildly alkaline; gradual, wavy boundary.

AC—6 to 15 inches, brown (10YR 5/3) fine sand, dark yellowish brown (10YR 3/4) when moist; single grain; loose, nonsticky and nonplastic; common fine roots; noncalcareous; mildly alkaline; diffuse, smooth boundary.

C1—15 to 26 inches, yellowish-brown (10YR 5/4) fine sand, dark yellowish brown (10YR 4/4) when moist; single grain; loose, nonsticky and nonplastic; few fine roots; noncalcareous; mildly alkaline; diffuse, smooth boundary.

C2—26 to 64 inches, yellowish-brown (10YR 5/4) fine sand, dark yellowish brown (10YR 4/4) when moist; single grain; loose, nonsticky and nonplastic; few fine roots; noncalcareous; mildly alkaline.

Texture of the A1 horizon is dominantly fine sand but is loamy fine sand in places. This horizon is 6 to 8 inches thick. The lower part of the C horizon is moderately calcareous in some areas.

This soil is very rapidly permeable. Runoff is very slow, and the hazard of water erosion is very slight. The hazard of soil blowing is high. This soil holds 2.5 to 3.75 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were small areas of soils where soil blowing has removed the surface layer.

This soil is used mostly for range. Some small areas are irrigated by sprinkler, and alfalfa and small grain are grown. Capability unit IVs–24, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Provo Series

The Provo series consists of poorly drained, very gravelly loamy soils. These soils formed in gravelly mixed alluvium derived from limestone, sandstone, and quartzite. They are on flood plains and fans at elevations of 4,475 to 4,650 feet. Slopes range from 0 to 3 percent. The vegetation is sedge, wiregrass, Kentucky bluegrass, and saltgrass. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 140 days. Provo soils are associated with Logan, Collett, Roshe Springs, and Winn soils.

In a representative profile, the surface layer is dark-gray to grayish-brown, mildly alkaline gravelly loam about 13 inches thick. The next layer is grayish-brown or light-gray, mildly alkaline very gravelly light loam 14 inches thick. Below this is light-gray, mildly alkaline very gravelly sandy loam to a depth of 60 inches or more.

Provo soils are used mainly for range.

Provo gravelly loam (Pv).—This undulating soil is on flood plains of rivers. Slopes range from 0 to 3 percent.

Representative profile in a wet meadow area, 1¼ miles south of Logan Sugar Factory, 40 feet north and 700 feet west of the southeast corner of sec. 17, T. 11 N., R. 1 E.:

O2—2 inches to 0, grayish-brown (10YR 5/2) peaty gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; soft, very friable, nonsticky and nonplastic; many fine and medium roots; strongly calcareous; mildly alkaline; clear, smooth boundary.

A11—0 to 7 inches, dark-gray (10YR 4/1) gravelly loam, black (10YR 2/1) when moist; strong, coarse, granular structure; slightly hard, friable, slightly sticky and plastic; common fine roots; 20 percent gravel; moderately calcareous; mildly alkaline; gradual, wavy boundary.

A12—7 to 13 inches, grayish-brown (2.5Y 5/2) gravelly loam, very dark grayish brown (2.5Y 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; 35 percent gravel; moderately calcareous; mildly alkaline; gradual, irregular boundary.

C1ca—13 to 19 inches, light-gray (10YR 7/2) very gravelly light loam, light brownish gray (10YR 6/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; 70 percent gravel; strongly calcareous; mildly alkaline; gradual, irregular boundary.

C2ca—19 to 27 inches, light-gray (10YR 7/2) very gravelly light loam, light brownish gray (10YR 6/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; 75 percent gravel; strongly calcareous; mildly alkaline; clear, wavy boundary.

C3ca—27 to 60 inches, light-gray (10YR 7/2) very gravelly sandy loam, light brownish gray (10YR 6/2) when moist; many, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; loose, nonsticky and nonplastic; 85 percent gravel; strongly calcareous; mildly alkaline.

In uncultivated areas a thin peaty horizon ranging from 1 to 3 inches in thickness has formed on the surface of the A1 horizon. The A1 horizon is dominantly gravelly loam but is silty loam in places. Strong-brown to dark yellowish-brown mottles are present in the C horizon. Texture of the C horizon, below a depth of 24 inches, ranges from very gravelly light loam to very gravelly loamy sand. In places, particularly in an area south of the old Logan Sugar Factory, the gravel in the C horizon is weakly cemented with lime. This is most common at a depth below 36 inches.

Permeability is moderately rapid. This soil is moderately difficult to till. Runoff is slow, and the hazard of erosion is slight. This soil holds about 3.5 inches of available water to a depth of 5 feet. Most roots are above the water table, which is at a depth of 26 to 36 inches.

Included in mapping were small areas of ponded soils, a few small areas of Roshe Springs silt loam, and small areas of soils that have slopes of 3 to 5 percent.

This soil is used mainly for native meadow pasture. Small areas have been partially drained and are used for irrigated crops of alfalfa, small grain, corn for silage, and pasture. (Capability unit Vw–2, nonirrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Provo loam (Pu).—This soil is on flood plains, mainly along the Blacksmith Fork and Little Bear Rivers. It is similar to Provo gravelly loam, except that it has little or no gravel in the upper 8 to 15 inches of the profile and its slopes are 0 to 1 percent. The surface layer is as much as 10 percent gravel in some places. The depth to the very gravelly substratum ranges from 13 to 37 inches.

The permeability is moderate in the surface layer and rapid in the gravelly substratum. Runoff is slow, and the hazard of erosion is slight. The depth to the water table normally ranges from 28 to 36 inches. In some places, however, drains have been installed and the water table has been lowered to a depth of 50 inches or more. Most roots penetrate to the gravelly material with ease.

Included in mapping were small areas of ponded soils and oxbows. Also included were small areas of Winn silt loam, 0 to 3 percent slopes.

This Provo soil is used mostly for irrigated crops of alfalfa, small grain, improved pasture, and corn for silage. A few acres of sugar beets also are grown. (Capability unit IIIw–2, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Quinney Series

The Quinney series consists of moderately well drained soils that are affected by salt and alkali. These soils formed in mixed lake sediment derived mainly from limestone and sandstone rocks. They are on low lake terraces at elevations of 4,420 to 4,500 feet. Slopes range from 0 to 2 percent. The vegetation is saltgrass, alkali sacaton, foxtail, cheatgrass, and greasewood. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Quinney soils are associated with Lewiston, Trenton, Kidman, and Airport soils.

In a representative profile, the surface layer is grayish-brown, mildly alkaline silt loam about 8 inches thick. The subsoil is grayish-brown and light brownish-gray, moderately and strongly alkaline loam about 10 inches thick. The substratum is very pale brown, very strongly alkaline loam to a depth of 39 inches. Between depths of 39 and 60 inches is very pale brown, strongly alkaline silty clay.

Most areas of Quinney soils are used for irrigated crops, but small areas are used for dryfarming and pasture.

Quinney silt loam (Qu).—This soil is on low lake terraces extending from the Lewiston-Cornish area south to the vicinity of the town of Benson. Slopes are 0 to 1 percent.

Representative profile in a cultivated area, 2 miles west and 1½ miles south of Lewiston, 100 feet north and 200 feet east of the southwest corner of the northwest quarter of sec. 18, T. 14 N., R. 1 E.:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine and medium pores; noncalcareous; mildly alkaline; clear, smooth boundary.

B21t—8 to 12 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine roots; many fine pores; thin continuous clay films; noncalcareous; moderately alkaline; gradual, smooth boundary.

B22t—12 to 18 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; many fine pores; many thin clay films; moderately calcareous; strongly alkaline; clear, smooth boundary.

C1ca—18 to 26 inches, pale-brown (10YR 6/3) heavy loam, brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common fine pores and few medium pores; strongly calcareous; very strongly alkaline; gradual, wavy boundary.

C2—26 to 39 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine pores; strongly calcareous; very strongly alkaline; abrupt, smooth boundary.

IIC3—39 to 60 inches, very pale brown (10YR 7/3) silty clay, brown (10YR 5/3) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; extremely hard, very firm, sticky and plastic; common fine pores; strongly calcareous; strongly alkaline.

The A horizon ranges from grayish brown to brown. Texture ranges from silt loam to fine sandy loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness ranges from 6 to 10 inches. The B2t horizon ranges from grayish brown or light brownish gray to brown or light brown in hues of 10YR and 7.5YR. Texture ranges from loam to very fine sandy loam or silt loam. The horizon is noncalcareous to moderately calcareous. Thickness ranges from 8 to 13 inches. The Cca and C horizons range from pale brown or very pale brown to light brown. Texture generally ranges from silt loam or loam to silty clay, but some areas are fine sandy loam. Most of the carbonate has been leached from the surface and redeposited in the lower part of the B horizon and upper part of the C horizon.

This soil is fairly easy to till. Permeability generally is moderately slow, but in an area south of Benson, the substratum is sandy loam and is rapidly permeable. Runoff is slow, and the hazard of erosion is none to slight. This soil holds 5 to 6 inches of available water to a depth of 5 feet. The fine-textured lake sediment generally present at a depth of 38 to 54 inches restricts the downward movement of water, and the water table is at a depth of 30 to 50 inches. Where drains have been installed, however, the water table generally is below a depth of 60 inches. Roots are mostly at a depth above the strongly alkali horizons.

Included in mapping were small areas of sandy loams and small slickspots that are strongly affected by salt and alkali.

This soil is used mostly for irrigated crops of alfalfa, barley, sugar beets, corn for silage, and alkali-tolerant pasture plants. Small areas are used for native pasture. (Capability unit IIIw-28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Red Spur Series

The Red Spur series consists of well-drained soils that have a cobbly sandy clay loam subsoil. These soils formed in residuum and colluvium derived from Wasatch sandstone and conglomerate rocks. They are on mountain slopes at elevations of 7,500 to 8,500 feet. Slopes range from 10 to 30 percent. The vegetation is aspen and an understory of big sagebrush, snowberry, mountain brome, Columbia needlegrass, slender wheatgrass, yarrow, and larkspur. The average annual precipitation ranges from 25 to 35 inches, the average annual air temperature is 35° to 40° F., and the average soil temperature in summer is less than 59°. The frost-free season is 60 to 80 days. Red Spur soils are associated with Lucky Star, Cluff, Scout, Agassiz, and Mult soils.

In a representative profile, the surface layer is brown to dark-brown, medium acid loam about 26 inches thick. The subsurface layer is pink, medium acid fine sandy loam about 12 inches thick. The next layer is pink fine sandy loam and red sandy clay loam about 10 inches thick. The subsoil is red, medium acid cobbly sandy clay loam to a depth of 56 inches. Below that depth is sandstone.

Representative profile of Red Spur loam, 10 to 30 percent slopes, in an area of Lucky Star-Red Spur complex, 6 to 30 percent slopes, 1 mile west and ½ mile north of Monte Cristo Guard Station, 2,000 feet north and 1,000 feet west of the southeast corner of sec. 31, T. 9 N., R. 4 E.:

A11—0 to 5 inches, brown to dark-brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; many medium and fine roots; slightly acid; clear, wavy boundary.

A12—5 to 26 inches, brown to dark-brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular structure; soft, friable, nonsticky and slightly plastic; many medium and fine roots; medium acid; clear, wavy boundary.

A2—26 to 38 inches, pink (7.5YR 7/4) fine sandy loam, strong brown (7.5YR 5/6) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; medium acid; gradual, wavy boundary.

A&B—38 to 48 inches, mixed about 70 percent pink (7.5YR 7/4) fine sandy loam (A2 horizon) and 30 percent red (2.5YR 4/6) (dry and moist) sandy clay loam (B2t horizon); moderate, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; few fine and medium roots; moderate continuous clay films on the B2t peds; medium acid; gradual, irregular boundary.

B2t—48 to 56 inches, red (2.5YR 4/6) (dry and moist) cobbly sandy clay loam; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky and plastic; few fine and medium roots; moderately thick continuous clay films on peds; medium acid.

R—56 inches, sandstone.

The combined thickness of the A1, A2, and B2t horizons ranges from 48 to more than 60 inches over sandstone. Coarse fragments are mainly cobblestone- and gravel-size, angular sandstone rock fragments that make up 20 to 50 percent in the A2 and B2t horizons. The A1 horizon ranges from brown to dark brown or reddish brown in a hue of 10YR, 7.5YR, or 5YR. Texture of the A1 horizon ranges from loam to very fine sandy loam. Thickness ranges from 22 to 30 inches. The A2 horizon ranges from brown to pink or reddish yellow in hues of 7.5YR and 5YR. Texture ranges from fine sandy loam to loamy fine sand. Reaction is medium acid to slightly acid. Thickness ranges from 10 to 13 inches. The A2 horizon tongues 4 to 13 inches into the B2t horizon. The B2t horizon ranges from red or reddish yellow to yellowish red or reddish brown in a hue of 2.5YR or 5YR. Texture is cobbly sandy clay loam to cobbly clay loam that is 20 to 50 percent cobblestones and gravel. Reaction is medium acid to slightly acid.

Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. These soils hold 6 to 8 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 4 feet or more.

Red Spur soils are used for range, watershed, wildlife habitat, and woodland.

In this survey area, the Red Spur soils are mapped only in a complex with the Lucky Star soils.

Richmond Series

The Richmond series consists of somewhat excessively drained, very cobbly and stony soils that formed in residuum and colluvium derived from limestone. The depth to limestone bedrock ranges from 10 to 20 inches. These soils are on south- and west-facing foot slopes of mountains at elevations of 5,100 to 6,500 feet. Slopes range from 30 to 70 percent. The vegetation is big sagebrush, bluebunch wheatgrass, cheatgrass, balsamroot, and juniper. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 100 to 120 days. Richmond soils are associated with Sterling, Nebeker, and Picayune soils.

In a representative profile, the surface layer is pale-brown, mildly alkaline very stony loam about 8 inches thick. The underlying layer is brown cobbly loam and pale-brown very cobbly loam. It is mildly alkaline and about 10 inches thick over limestone bedrock.

Richmond soils are used for range, watershed, and wildlife habitat.

Richmond very stony loam, 30 to 70 percent slopes, eroded (RCG2).—This soil is on the west- and south-facing mountain foothills along the east side of Cache Valley.

Representative profile, under native shrubs and grass in Hyde Park Canyon, about 1,000 feet south and 100 feet west of the northeast corner of sec. 1, T. 12 N., R. 1 E.:

A1—0 to 8 inches, pale-brown (10YR 6/3) very stony loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; many fine roots and few medium and large roots; many fine and medium interstitial pores; very strongly calcareous; mildly alkaline; clear, wavy boundary.

C1—8 to 13 inches, brown (10YR 5/3) cobbly loam, dark brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure that parts to weak, fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; many fine roots and few medium roots; many fine pores; very strongly calcareous; mildly alkaline; gradual, wavy boundary.

C2—13 to 18 inches, pale-brown (10YR 6/3) very cobbly loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; many fine roots and few medium roots; very strongly calcareous; mildly alkaline.

R—18 inches, fractured limestone bedrock.

The A1 horizon ranges from pale brown to brown or light-grayish brown. Its texture is loam that is very stony, cobbly, or very cobbly. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to very strongly calcareous. Thickness ranges from 6 to 9 inches. The C horizon ranges from pale brown or brown to very pale brown or grayish brown. Reaction is mildly alkaline to moderately alkaline, and the horizon is strongly calcareous to very strongly calcareous. Coarse fragments are mainly cobblestones and gravel derived from limestone and a few stones. Their content ranges from 20 to 70 percent in the A horizon and the upper part of the C horizon and from 50 to 80 percent in the lower part of the C horizon. The fine fraction commonly is less than 15 percent carbonates; however, the carbonate equivalent throughout the profile, including coarse fragments as much as three-fourths inch in diameter, is more than 40 percent.

Permeability is moderately rapid. Runoff is rapid, and the hazard of erosion is high. This soil is moderately eroded. It holds 1.5 to 2 inches of available water above bedrock. Roots are at a depth of 10 to 20 inches. Some roots penetrate into cracks in the bedrock.

This soil is used for range, watershed, and wildlife habitat. (Capability unit VIIs–UX3, nonirrigated; Upland Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Richmond-Middle association, eroded (30 to 70 percent slopes) (RDG2).—This mapping unit is on mountain slopes on the west side of Clarkston and Wellsville Mountains. About 40 percent of the association is Richmond very stony loam, 30 to 70 percent slopes, eroded; 30 percent is Middle cobbly loam, 30 to 70 percent slopes; 20 percent is rock outcrop; and 10 percent is included soils.

The Richmond soil is on the lower part of south- and southwest-facing slopes. The Middle soil is on north-facing slopes below ridges.

Included in mapping were areas of very shallow, stony soils that are 7 to 10 inches deep over limestone bedrock, and areas of soils that are steeper. The shallow soils and rock outcrop are intermingled with areas of the Richmond soil.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Richmond soil is in capability unit VIIs–UX3, nonirrigated; Upland Shallow Loam range site. Middle soil is in capability unit VIIs–U4, nonirrigated; Upland Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 2)

Richmond-Munk association, eroded (30 to 70 percent slopes) (REG2).—This mapping unit is on the north end of Clarkston Mountain near the Idaho line. About 50 percent of the association is Richmond very stony loam, 30 to 70 percent slopes, eroded; 35 percent is Munk gravelly loam, 30 to 70 percent slopes, eroded; and 15 percent is included soils.

The Richmond soil is on the south- and southwest-facing mountain slopes. It is very shallow, is excessively drained, and contains ashy material from the Salt Lake Formation. Permeability is moderately rapid. Runoff is rapid, and the hazard of erosion is very high. This soil holds less than 1½ inches of available water above bedrock. Some roots penetrate into the cracks in the bedrock. The vegetation is scattered stands of mountain-mahogany and juniper and a sparse understory of bluebunch wheatgrass.

The Munk soil is on the north- and east-facing mountain slopes. In these areas, the vegetation is thick stands of mountain-mahogany.

Included in mapping were areas of Barfuss silt loam, 30 to 50 percent slopes, and areas of Wheelon silt loam, 30 to 50 percent slopes, eroded. The Barfuss soil makes up 10 percent of the association and the Wheelon soil 5 percent.

Soils of this mapping unit are used for watershed, wildlife habitat, and limited grazing. (Richmond soil is in capability unit VIIs–UX3, nonirrigated; Upland Shallow Loam range site. Munk soil is in capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 2)

Richmond-Nebeker association, eroded (30 to 70 percent slopes) (RFG2).—This mapping unit is on rolling foothills of mountains along the east side of Cache Valley and extends from Hyde Park to the Richmond area. About 40 percent of the association is Richmond very stony loam, 30 to 70 percent slopes, eroded; 25 percent is Nebeker silt loam, 30 to 40 percent slopes; 20 percent is Sterling cobbly loam, 30 to 60 percent slopes, eroded; and 15 percent is included soils.

The Richmond soil is on south- and west-facing slopes and on ridges. The vegetation is grass and shrubs.

The Sterling and Nebeker soils are on north-facing slopes. The Sterling soil is commonly on the upper part of the slopes, and the Nebeker soil is in the lower, more concave areas. The Sterling soil is similar to Sterling gravelly loam, 30 to 50 percent slopes, eroded, except that the surface layer is about 30 percent cobblestones and is slightly darker colored. The Nebeker soil is similar to Nebeker silt loam, 10 to 25 percent slopes, except that it has slopes of 30 to 40 percent.

Included in mapping were areas of Smarts gravelly silt loam, 30 to 70 percent slopes, and areas of Hiibner extremely stony clay loam, 30 to 50 percent slopes, eroded.

Soils of this mapping unit are used for range, wildlife habitat, and watershed. (Richmond soil is in capability unit VIIs–UX3, nonirrigated; Upland Shallow Loam range site. Nebeker soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Sterling soil is in capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site. None of these soils is in a woodland suitability group; Richmond and Sterling soils are in wildlife suitability group 2; Nebeker soil is in wildlife suitability group 3)

Richmond-Sterling association, eroded (30 to 70 percent slopes) (RGG2).—This mapping unit is on foot slopes of mountains along the east side of Cache Valley and extends from Smithfield to the Idaho line. About 50 percent of the association is Richmond very stony loam, 30 to 70 percent slopes, eroded; 35 percent is Sterling cobbly loam, 30 to 60 percent slopes, eroded; and about 15 percent is included soils.

The Richmond soil is on the south-facing slopes of draws and canyons and on ridges.

The Sterling soil is in slightly concave areas, mainly on the upper part of north-facing slopes. It is similar to Sterling gravelly loam, 10 to 20 percent slopes, except that it is steeper, it is eroded, and the surface layer is 30 percent cobblestones.

Included in mapping were areas of a moderately deep, well-drained, cobbly and gravelly, medium-textured soil, and areas of Nebeker silt loam, 30 to 40 percent slopes. The moderately deep soil makes up about 10 percent of the association, and the Nebeker soil about 5 percent. These inclusions are on the lower part of north-facing slopes, and the vegetation generally is scrubby maple and other browse.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Richmond soil is in capability unit VIIs–UX3, nonirrigated; Upland Shallow Loam range site. Sterling soil is in capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 2)

Ricks Series

The Ricks series consists of somewhat excessively drained, gravelly soils that are 15 to 30 inches deep over very gravelly sand. These soils formed in mixed alluvium and deltaic sediment derived from limestone, sandstone, and quartzite. They are on medium and high lake terraces at elevations of 4,500 to 5,700 feet. Slopes range from 0 to 10 percent. The vegetation is bluebunch wheatgrass, balsamroot, and big sagebrush. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 130 to 160 days. Ricks soils are associated with Sterling, Steed, Parleys, and Timpanogos soils.

In a representative profile (fig. 10), the surface layer and subsoil are brown, mildly alkaline gravelly loam and

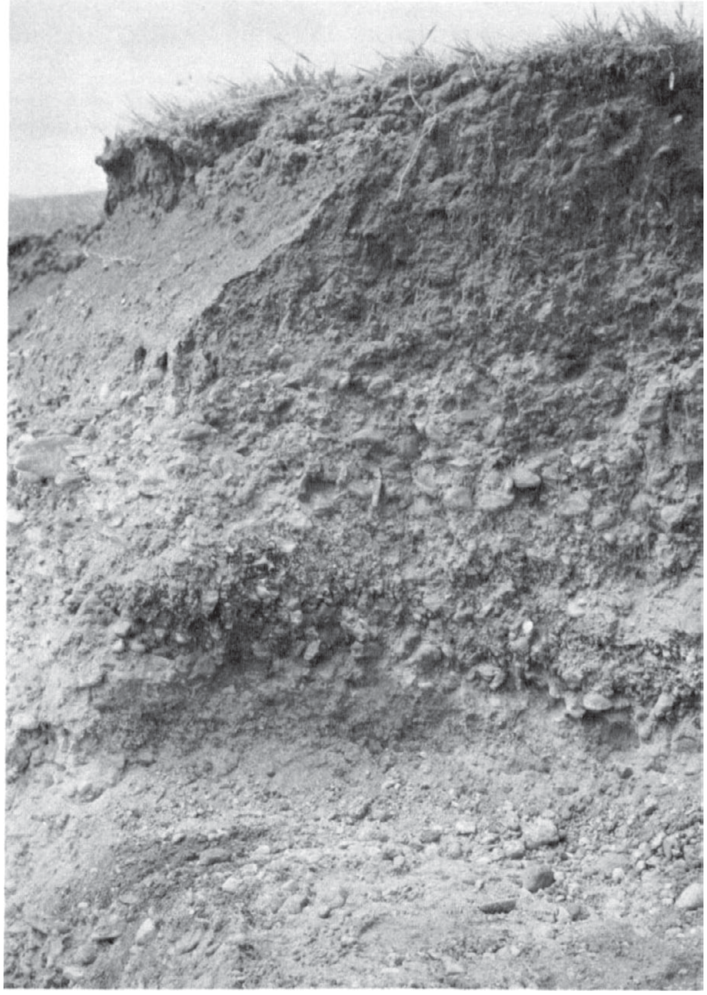

***Figure 10.*—Profile of Ricks gravelly loam, 0 to 3 percent slopes.**

gravelly sandy loam about 18 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown very gravelly and cobbly sand.

Ricks soils are used mostly for irrigated and dryfarmed crops of alfalfa and small grain. Some areas are used for orchard, range, or community developments.

Ricks gravelly loam, 0 to 3 percent slopes (RhA).—This soil is on the rather narrow lake terraces and broad deltas along the east side of Cache Valley.

Representative profile, 1 mile east and 1,600 feet south of the southeast corner of Hyrum city rodeo grounds, 700 feet north and 200 feet east of the southwest corner of sec. 2, T. 10 N., R. 1 E.:

Ap—0 to 4 inches, brown (10YR 5/3) gravelly light loam, dark brown (10YR 3/3) when moist; mixed weak, medium, subangular blocky structure and weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few fine pores; noncalcareous; mildly alkaline; clear, smooth boundary.

A1—4 to 9 inches, brown (10YR 5/3) gravelly light loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure that parts to weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine and medium pores; few thin clay films in pores; noncalcareous; mildly alkaline; clear, wavy boundary.

B2—9 to 14 inches, brown (7.5YR 5/3) gravelly light loam, dark brown (7.5YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine and medium pores; common thin clay films; noncalcareous; mildly alkaline; clear, smooth boundary.

B3ca—14 to 18 inches, brown (7.5YR 5/3) gravelly heavy sandy loam, dark brown (7.5YR 3/3) when moist; weak, medium, subangular blocky structure; loose, very friable, nonsticky and nonplastic; common fine roots; common fine and medium pores; moderately calcareous; mildly alkaline; abrupt, smooth boundary.

IIC1ca—18 to 24 inches, very pale brown (10YR 7/3) very gravelly and cobbly sand, pale brown (10YR 6/3) when moist; single grain; loose, nonsticky and nonplastic; very strongly calcareous; moderately alkaline; gradual, wavy boundary.

IIC2ca—24 to 60 inches, very pale brown (10YR 7/3) very gravelly and cobbly sand, pale brown (10YR 6/3) when moist; single grain; loose, nonsticky and nonplastic; very strongly calcareous; moderately alkaline.

The A horizon ranges from brown to dark brown or to dark grayish brown in a hue of 10YR or 7.5YR. Reaction is neutral to mildly alkaline. Thickness ranges from 4 to 12 inches. The B2 horizon ranges from brown to reddish brown in a hue of 7.5YR or 5YR. Texture ranges from gravelly loam to gravelly heavy sandy loam. Thickness ranges from 5 to 10 inches. The C horizon ranges from very pale brown to light brown or light brownish gray in hues of 10YR and 7.5YR. Texture is very gravelly or very cobbly sand to very gravelly loamy sand. Depth to the IIC horizon of very gravelly or very cobbly sand ranges from 15 to 30 inches. The coarse fragments are mainly rounded gravel-size quartzite, sandstone, or limestone. Their content ranges from 15 to 45 percent in the A and B horizons and 50 to 80 percent in the C horizon.

This soil is fairly easy to till, but the gravel causes excessive wear on tillage implements. Permeability is moderately rapid. Runoff is slow, and the hazard of erosion is slight. This soil holds 3 to 4 inches of available water to a depth of 5 feet. Most roots are in the surface layer and subsoil above the very gravelly material.

Included in mapping were small areas of Timpanogos silt loam, 0 to 3 percent slopes.

This Ricks soil is used for irrigated and dryfarmed crops and for community developments. About 50 percent of the cropland is used for irrigated crops of small grain, alfalfa, and orchards. The other 50 percent is used for dryfarmed small grain and alfalfa. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Ricks gravelly loam, 3 to 6 percent slopes (RhB).—This soil is in long, narrow bands on medium lake terraces. It is associated with Ricks gravelly loam, 0 to 3 percent slopes, and, except for slope, is similar to that soil. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Timpanogos silt loam, 3 to 6 percent slopes, and Sterling gravelly loam, 6 to 10 percent slopes.

This Ricks soil is well suited to orchards in areas where good air movement reduces frost damage and irrigation water is available. About 50 percent of the cropland is irrigated. The principal crops are small grain, alfalfa, and orchard crops. The other 50 percent is used for dryfarmed crops of small grain and small pastures. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Ricks gravelly loam, 6 to 10 percent slopes (RhC).—This soil is in long, narrow bands on lake terrace escarpments. Except for slope, it is similar to Ricks gravelly loam, 0 to 3 percent slopes. The surface layer is 4 to 6 inches thick and is cobbly and moderately calcareous in places. The average depth to the very gravelly substratum is about 16 inches. This soil holds 3.0 to 3.5 inches of available water to a depth of 5 feet. Runoff is medium, and the hazard of erosion is moderate.

This soil is used mostly for irrigated crops of alfalfa or grass (fig. 11) and for orchards, uses to which it is suited. Some of the more narrow areas are in native vegetation consisting of sagebrush and bluebunch wheatgrass. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Riverwash

Riverwash (Rk) is a miscellaneous land type that consists of bars of mixed sand and gravel along streams. It is often overflowed during spring runoff. There is little vegetation, but sparse stands of weeds and willows that grow along the streambanks provide some protection from erosion. Yields of usable forage are negligible.

This land type is suited mainly to wildlife habitat. (Capability unit VIIIw–4, nonirrigated; not in a range site, a woodland suitability group, or a wildlife suitability group)

Rock Land

Rock land (RO) is a miscellaneous land type consisting of areas that contain enough rock outcrop and very shallow soil material to be dominant over other soil charac-

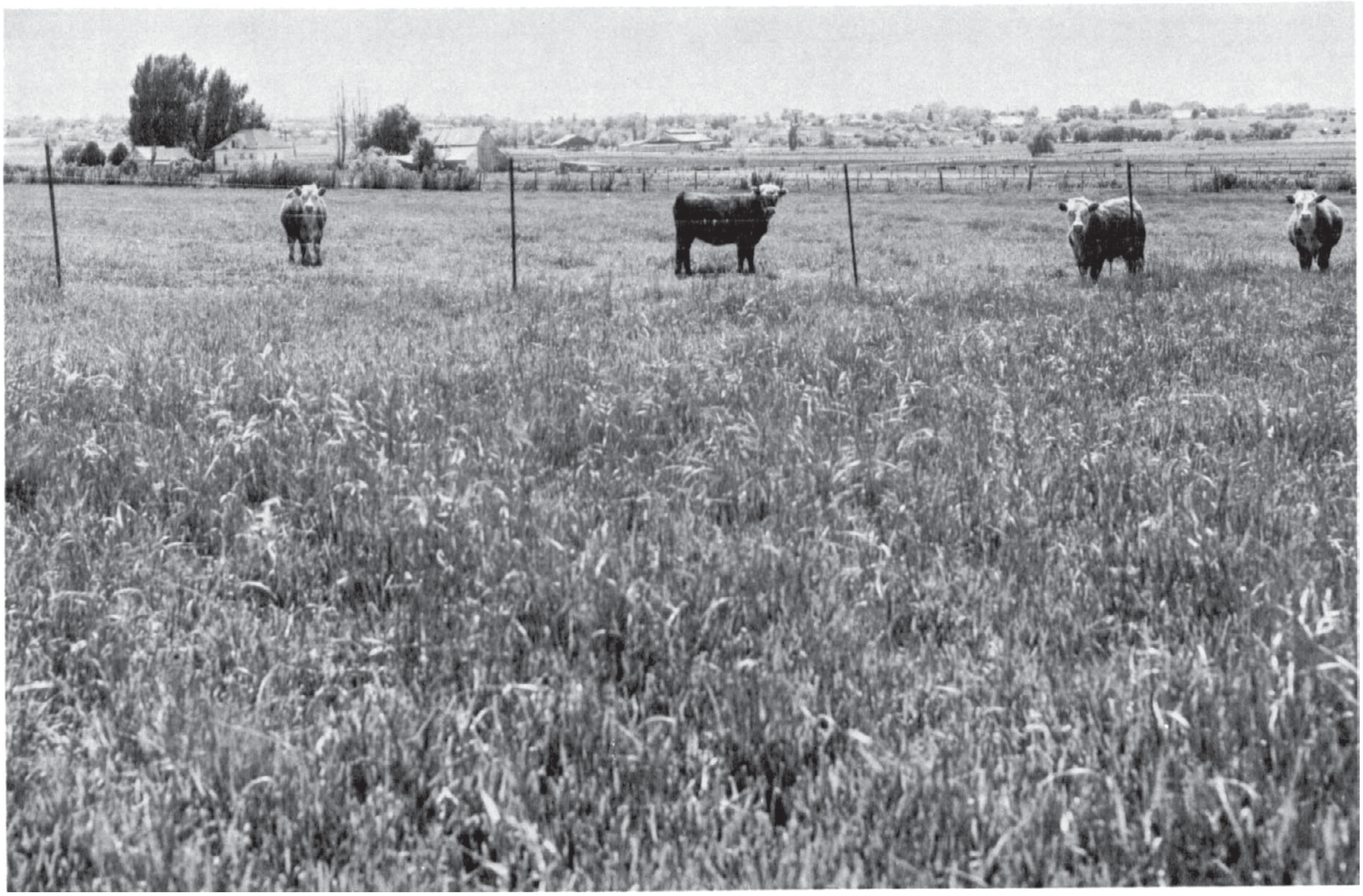

***Figure 11.*—Irrigated pasture on Ricks gravelly loam, 6 to 10 percent slopes.**

teristics. It is made up of rock outcrop, talus material, and areas of extremely stony land on very steep mountain slopes, canyon walls, and ridges. The rocks are mainly limestone and quartzite but partly sandstone and conglomerate. The scattered vegetation is variable but includes bluebunch wheatgrass, maple, juniper, bitterbrush, big sagebrush, and some conifer and aspen trees.

Included with Rock land in mapping were areas of Agassiz soils.

The land type is used for watershed and wildlife. (Capability unit VIIIs–X; not in a range site, a woodland suitability group, or a wildlife suitability group)

Roshe Springs Series

The Roshe Springs series consists of poorly drained soils. These soils formed in mixed, very strongly calcareous alluvium under the influence of a high water table in depressional areas. They are on concave, low lake terraces and fans at elevations of 4,450 to 4,600 feet. Slopes range from 0 to 3 percent. The vegetation is sedges, wiregrass, Kentucky bluegrass, saltgrass, and bulrush. The average annual precipitation ranges from 14 to 17 inches. the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 140 days. Roshe Springs soils are associated with Logan, Greenson, Collett, Salt Lake, Provo, and Cardon soils.

In a representative profile, the soil is dark-gray to white, moderately alkaline, very strongly calcareous or strongly calcareous silt loam to a depth of 60 inches or more.

Roshe Springs soils generally are used for native pasture, but small drained areas are used for irrigated crops.

Roshe Springs silt loam (Rs).—This soil is in poorly drained depressions on low lake terraces and fans near the bottom of Cache Valley. Slopes range from 0 to 3 percent.

Representative profile in a native meadow, one-fourth mile east of the California Packing Company plant in Hyrum, 2,000 feet east of the southwest corner of sec. 33, T. 11 N., R. 1 E.:

O1—2 inches to 0, matted roots and plant material.

A1—0 to 8 inches, dark-gray (2.5Y 4/1) silt loam, very dark gray (2.5Y 3/1) when moist; weak, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; many medium roots and few large roots; few fine pores; moderately calcareous; moderately alkaline; clear, smooth boundary.

C1ca—8 to 14 inches, light-gray (5Y 7/1) silt loam, gray to light gray (5Y 6/1) when moist; massive; slightly hard, friable, slightly sticky and plastic; many fine and medium roots; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C2ca—14 to 23 inches, white (5Y 8/1) silt loam, light gray (5Y 7/1) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C3ca—23 to 35 inches, light-gray (5Y 7/1) silt loam, gray to light gray (5Y 6/1) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous; moderately alkaline; diffuse, wavy boundary.

C4—35 to 60 inches, light-gray (5Y 7/2) silt loam, light brownish gray (2.5Y 6/2) when moist; many, medium, prominent, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline.

A peaty horizon as much as 2 inches thick covers the A1 horizon in places. The A1 horizon is dominantly silt loam but is loam in places and is 8 to 15 inches thick. It ranges from dark gray to gray in a hue of 10YR or 2.5Y. The C horizon ranges from silt loam to light silty clay loam. In places the C horizon contains lime nodules and is weakly cemented. The Cca and C horizons have a hue of 2.5Y or 5Y. In places strata of sand and gravel are below a depth of 40 inches. Reaction is moderately alkaline to strongly alkaline.

This soil is moderately permeable. Runoff is slow, and the hazard of erosion is none to slight. If this soil is drained, it holds 8 to 10 inches of available water to a depth of 5 feet. The depth to the water table normally is 10 to 36 inches, but some areas are ponded part of the year. In some drained areas, the water table has been lowered a depth of 60 inches. Roots penetrate the soil easily.

Included in mapping were small areas of Logan silty clay loam and small ponded areas on which the vegetation is cattails and bulrushes.

The Roshe Springs soil is used mostly for range. About 25 percent of the acreage has been partially drained and is used for irrigated crops of small grain, corn for silage, improved pasture, and sugar beets. (Capability unit IIIw–2, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Rough Broken Land

Rough broken land (Rt) is a miscellaneous land type that consists of very steep areas on long escarpmentlike breaks into deep stream bottoms. The areas are broken by intermittent drainage channels. The vegetative cover is grass and shrubs. This land type is used mainly for wildlife habitat. Some areas are used for limited grazing. Runoff is very rapid, and soil slippage is common. Geologic erosion is active in many areas. Drainage from higher irrigated areas causes frequent seeps and wet spots along the breaks. These wet areas are used for limited grazing. (Capability unit VIIe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

St. Marys Series

The St. Marys series consists of well-drained soils that have a very cobbly fine sandy loam subsoil. These soils formed in colluvium and residuum derived from sandstone, conglomerate, and quartzite. They are on convex south- and west-facing mountain slopes at elevations of 6,500 to 8,000 feet. Slopes range from 30 to 60 percent. The vegetation is bluebunch wheatgrass, Great Basin wildrye, big sagebrush, bitterbrush, and yellowbrush. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature is 36° to 44° F., and the frost-free season is 80 to 100 days. St. Marys soils are associated with Curtis Creek, Ant Flat, and Scave soils.

In a representative profile, the surface layer is brown to dark-brown, slightly acid gravelly very fine sandy loam about 16 inches thick. The subsoil is yellowish-red, neutral very cobbly fine sandy loam about 11 inches thick. The substratum is strong-brown, neutral very cobbly fine sandy loam, to a depth of 60 inches or more.

St. Marys soils are used for range, watershed, and wildlife habitat.

St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes (SAG).—This soil is on south- and west-facing mountain slopes near the Blake Hollow area east of Ant Valley.

Representative profile in an area of native vegetation, about 1,000 feet north and 100 feet west of the southeast corner of sec. 2, T. 8 N., R. 3 E.:

A11—0 to 9 inches, brown to dark-brown (7.5YR 4/2) gravelly fine sandy loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many fine and medium roots; 35 percent gravel; slightly acid; clear, wavy boundary.

A12—9 to 16 inches, brown (7.5YR 5/3) gravelly very fine sandy loam, dark brown (7.5YR 3/4) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many fine and medium roots; common, very fine, tubular pores; 40 percent gravel; slightly acid; gradual, irregular boundary.

B2—16 to 27 inches, yellowish-red (5YR 5/6) very cobbly fine sandy loam, yellowish red (5YR 4/6) when moist; very weak, fine, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; common fine and medium roots; 70 percent cobblestones and gravel; neutral; abrupt, wavy boundary.

C—27 to 60 inches, strong-brown (7.5YR 5/6) very cobbly fine sandy loam, reddish brown (5YR 4/4) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and medium roots; 85 percent cobblestones and gravel; moderately calcareous; neutral.

The A1 horizon ranges from brown or dark brown to reddish brown in hues of 7.5YR and 5YR. Texture is gravelly very fine sandy loam to gravelly light loam. Thickness ranges from 9 to 20 inches. The B2 horizon ranges from yellowish red to reddish brown, light reddish brown, or strong brown. Texture is very cobbly very fine sandy loam to very gravelly fine sandy loam or very cobbly light loam. Reaction ranges from slightly acid to mildly alkaline. The C horizon ranges from strong brown to reddish brown or light reddish brown in hues of 7.5YR and 5YR. Reaction ranges from neutral to moderately alkaline, and the horizon is noncalcareous to moderately calcareous. The combined thickness of the A1 and B2 horizons ranges from 24 to 32 inches. Bedrock is at a depth of 40 to 55 inches in places. The content of cobblestones and gravel generally increases with depth, ranging from 20 to 50 percent in the A horizon and from 50 to 80 percent in the B2 and C horizons.

Permeability is moderate to moderately rapid. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds about 4 to 5 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Included in mapping were areas of Curtis Creek loam, 30 to 60 percent slopes, and Goring silt loam, 6 to 30 percent slopes. The Curtis Creek soil makes up about 5 percent of the mapped areas, and the Goring soil about 2 percent.

This St. Marys soil is used for range, watershed, and wildlife habitat. (Capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

St. Marys-Curtis Creek association (30 to 60 percent slopes) (SCG).—This mapping unit is north and east of Hardware Ranch. About 65 percent of the association is St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes; 30 percent is Curtis Creek loam, 30 to 60 percent slopes; and about 5 percent is included small areas of Lucky Star gravelly silt loam, 30 to 60 percent slopes.

These soils are on dominantly south-facing mountain slopes. The St. Marys soil is commonly on the lower two-thirds of slopes, and the Curtis Creek soil is on the upper one-third of slopes and on spur ridges. The surface layer is 5 to 25 percent cobblestones and gravel and is 8 to 10 inches thick. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The vegetation is shrubs and grass.

Soils of this mapping unit are used for range, wildlife habitat, and watershed. (St. Marys soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Curtis Creek soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 3)

Salt Lake Series

The Salt Lake series consists of poorly drained and very poorly drained soils that formed in very strongly calcareous, mixed lake sediment derived from limestone and quartzite. These soils are on low lake terraces at elevations of 4,420 to 4,470 feet. Slopes are 0 to 1 percent. The vegetation is sedges, cattails, bulrush, foxtail, and saltgrass. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Salt Lake soils are associated with Logan, Roshe Springs, Airport, Trenton, Cardon, and Greenson soils.

In a representative profile, the soil is very dark gray to light-gray and light brownish-gray, mildly alkaline to strongly alkaline silty clay that extends to a depth of 60 inches or more.

Salt Lake soils are used mostly for range or for meadow hay.

Salt Lake silty clay (Se).—This soil is in smooth areas or in slightly concave depressions on low lake terraces in the central part of Cache Valley. The slopes are dominantly less than 1 percent.

Representative profile in a meadow, 2½ miles south of Benson, 1,000 feet north and 200 feet east of the southwest corner of the southeast quarter of sec. 23, T. 12 N., R. 1 W.:

O1—2 inches to 0, matted roots and plant material.

A1—0 to 7 inches, very dark gray (10YR 3/1) silty clay, black (10YR 2/1) when moist; weak, medium, granular structure; very hard, firm, slightly sticky and plastic; many fine and medium roots; few fine pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

ACcag—7 to 15 inches, gray (2.5Y 5/1) silty clay, very dark gray (2.5Y 3/1) when moist; weak, coarse, subangular blocky structure; very hard, very firm, sticky and plastic; common fine, medium, and large roots; few medium pores; very strongly calcareous; moderately alkaline; gradual, smooth boundary.

C1cag—15 to 36 inches, gray to light-gray (2.5Y 6/1) silty clay, gray (2.5Y 5/1) when moist; massive; very hard, very firm, sticky and plastic; few fine roots and common medium roots; very strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2—36 to 66 inches, light brownish-gray (10YR 6/2) silty clay, grayish brown (10YR 5/2) when moist; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; extremely hard, very firm, sticky and very plastic; few medium roots; common fine pores; strongly calcareous; strongly alkaline.

A peaty horizon, 1 to 4 inches thick, commonly overlies the A1 horizon. The A1 horizon ranges from very dark gray to gray in hues of 10YR and 2.5Y. Texture ranges from silty clay to heavy silty clay loam. Reaction is mildly alkaline to moderately alkaline. Thickness ranges from 6 to 16 inches. The Cca and C horizons range from gray or light gray to light brownish gray or white in a hue of 10YR, 2.5Y, or 5Y. Texture is silty clay to clay. Generally, the exchangeable sodium percentage is less than 15 in the A horizon and increases with depth to 15 to 35 below a depth of 20 inches. Depth to the horizon of carbonate accumulation ranges from 6 to 15 inches. In places the C1cag horizon is weakly cemented. The water table fluctuates from the surface to a depth of 30 inches in undrained areas, but it is at a depth of more than 60 inches in drained areas.

This soil is very slowly permeable. Runoff is very slow to ponded, and the hazard of erosion is slight to none. If the soil is drained, it holds about 10 inches of available water to a depth of 5 feet. Roots penetrate to the water table.

Included in mapping were small areas of soils that are affected by salt and alkali.

This soil is used mostly for meadow pasture and hay. (Capability unit Vw–2, nonirrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Salt Lake silty clay loam (Sd).—This soil is on low lake terraces about 6 miles southwest of the city of Logan. It is similar to Salt Lake silty clay, except that it has a surface layer of silty clay loam and a strong horizon of gypsum accumulation at a depth of about 30 inches. The surface layer ranges from 7 to 14 inches in thickness. The depth to the water table is mostly 36 to 45 inches, but it ranges to as much as 60 inches where the soil is drained. The depth to distinct mottles ranges from 13 to 30 inches. The content of calcium sulfate in the lower part of the substratum is 6 to 12 percent.

This soil is moderately difficult to till. It compacts if worked when too wet. It is poorly drained, and permeability is slow. If this soil is drained, it holds 10 to 12 inches of available water to a depth of 5 feet. Runoff is slow, and the hazard of erosion is slight. Roots penetrate to a depth of 3 to 4 feet.

Included in mapping were small areas of soils that have slopes of 1 to 3 percent and small areas of Salt

Lake silty clay. Also included were small areas of soil that are slightly affected by salt and alkali.

Most areas of this soil are artificially drained and are used for irrigated crops of alfalfa, small grain, sugar beets, corn for silage, and improved pasture. (Capability unit IIIw–25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Salt Lake-Logan complex (Sf).—This complex is in low-lying areas on low lake terraces, mainly in an area 2 miles northeast of the community of Young Ward. In these areas the topography is undulating. About 50 percent of the complex is Salt Lake silty clay loam, and about 50 percent is Logan silty clay loam. The Salt Lake soil is on slightly elevated mounds, and the Logan soil is in lower, poorly drained depressions surrounding the mounds. Slopes generally are less than 1 percent.

The Salt Lake soil is similar to Salt Lake silty clay, except that it has a surface layer of silty clay loam, about 8 inches thick, and a horizon of gypsum accumulation at a depth of about 30 inches. The surface layer ranges from 7 to 14 inches in thickness. The depth to the water table is mainly 36 to 45 inches but ranges to as much as 60 inches in drained areas. The depth to distinct mottles ranges from 13 to 30 inches. The calcium sulfate percentage in the lower part of the substratum ranges from 6 to 12.

The Salt Lake soil is moderately difficult to till. It compacts if worked when too wet. It is poorly drained, and its permeability is slow. If this soil is drained, it holds 10 to 12 inches of available water to a depth of 5 feet. Runoff is slow, and the hazard of erosion is slight. Roots penetrate to a depth of 3 to 4 feet.

The Logan soil is similar to Logan silty clay loam, which is described under the Logan series.

Soils of this mapping unit are mostly used for range. A small acreage has been drained and leveled and is used for irrigated crops of small grain, sugar beets, and improved pasture. (Capability unit IIIw–25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Salt Lake-Roshe Springs complex (Sg).—This complex is mainly in an area east of the city of Mendon. About 60 percent of the complex is Salt Lake silty clay, and 40 percent is Roshe Springs silt loam.

The Salt Lake soil is in channels and swales. It is poorly drained and slowly permeable. Runoff is slow, and the hazard of erosion is slight.

The Roshe Springs soil is on mounds. It is similar to Roshe Springs silt loam, described under the Roshe Springs series, except that it has a slowly permeable substratum and commonly is slightly or moderately affected by salt and alkali.

Included in mapping were small areas of Airport silty clay loam.

Soils of this mapping unit are used for range and wildlife habitat. (Capability unit Vw–2, nonirrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Salt Lake-Trenton complex (Sh).—This complex is in a few rather large areas on low lake terraces north of Valley View Highway and Benson Road Junction. About 60 percent of the complex is Salt Lake silty clay, and about 40 percent is Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes.

The Salt Lake soil generally is in depressions, where runoff is very slow to ponded. The Trenton soil is on slightly raised knolls, where runoff is slow. Many areas have been rough leveled, however, and no topographic separation of the two soils can be observed. The hazard of erosion is slight.

Included in mapping were small areas of Logan silty clay loam and small areas of a soil that has slopes of 2 to 3 percent.

Soils of this mapping unit are used mainly for range and meadow hay. A small acreage is in improved pasture. (Both soils in capability unit Vw–2, nonirrigated; Salt Lake soil, Wet Meadow range site. Trenton soil, Alkali Bottom range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 1)

Scave Series

The Scave series consists of well-drained soils that have a very cobbly clay subsoil. These soils formed in residuum and colluvium derived from sandstone, shale, and quartzite rocks. They are on mountain slopes at elevations of 6,200 to 7,500 feet. Slopes range from 10 to 30 percent. The vegetation is aspen and scattered Douglas-fir and an understory of snowberry, mountain brome, blue wildrye, oniongrass, slender wheatgrass, and peavine. The average annual precipitation ranges from 20 to 30 inches, the mean annual temperature is 36° to 42° F., and the mean soil temperature in summer is less than 59°. The frost-free season is 80 to 100 days. Scave soils are associated with Lucky Star, Ant Flat, Hoskin, and Despain soils.

In a representative profile, the surface layer is dark-brown and brown, medium acid silt loam about 16 inches thick. The subsurface layer is brown, slightly acid cobbly loam about 18 inches thick. The subsoil is reddish-brown, medium acid very cobbly clay to a depth of 60 inches or more.

Scave soils are used for range, woodland, watershed, and wildlife habitat.

Scave silt loam, 10 to 30 percent slopes (SIE).—This soil is on east- and north-facing mountain slopes surrounding Ant Flat south of Hardware Ranch.

Representative profile, 1½ miles south and 2 miles west of Anderson Ranch headquarters, about 1,000 feet north of the center of sec. 9, T. 9 N., R. 3 E.:

O1—2 inches to 0, matted decaying leaves and twigs.

A1—0 to 10 inches, dark-brown (7.5YR 4/2) silt loam, very dark brown (7.5YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many large and medium roots; few fine interstitial pores; 5 percent gravel; medium acid; gradual, wavy boundary.

A1&A2—10 to 16 inches, dark-brown (7.5YR 4/3) and brown (7.5YR 5/4) silt loam, very dark brown (7.5YR 2/2) and dark brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many large, medium, and small roots; few fine interstitial pores; 15 percent gravel; medium acid; gradual, wavy boundary.

A2—16 to 34 inches, brown (7.5YR 5/4) cobbly loam, brown to dark brown (7.5YR 4/4) when moist; weak, medium and coarse, subangular blocky structure;

soft, very friable, nonsticky and nonplastic; common medium and small roots; many medium and fine interstitial pores; 30 to 40 percent cobblestones and gravel; slightly acid; abrupt, smooth boundary.

B21t—34 to 46 inches, reddish-brown (2.5YR 5/4) very cobbly clay, red (2.5YR 4/6) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; many medium and fine tubular pores; moderately thick continuous clay films; 60 percent cobblestones; medium acid; few, fine, black concretions and stains; gradual, wavy boundary.

B22t—46 to 60 inches, same as B21t horizon, but has 80 to 90 percent cobblestones and a few stones.

The combined thickness of the A1, A2, and B2t horizons ranges from 50 to more than 75 inches. Coarse fragments are mostly cobblestone- and stone-size angular sandstone. Their content ranges from 5 to 20 percent in the A1 horizon, from 30 to 70 percent in the A2 horizon, from 50 to 70 percent in the upper part of the B2t horizon, and from 70 to 90 percent in the lower part of the B2t horizon. The A1 horizon ranges from dark brown to brown in hues of 10YR and 7.5YR. Texture is silt loam to gravelly silt loam. Reaction ranges from medium acid to neutral. Thickness ranges from 10 to 16 inches. The A2 horizon ranges from brown to light brown or reddish brown in a hue of 10YR, 7.5YR, or 5YR. Texture ranges from cobbly loam or very cobbly loam to gravelly fine sandy loam. Reaction is medium acid to slightly acid. Thickness ranges from 10 to 24 inches. The B2t horizon ranges from reddish brown or red to yellowish red or light reddish brown in hues of 5YR and 2.5YR. Texture ranges from very cobbly clay to very cobbly heavy clay loam.

Permeability is slow. Runoff is medium, and the hazard of erosion is moderate. The soil holds 5 to 7 inches of available water in a 5 foot depth. Roots penetrate to depths of 5 feet or more.

Included in mapping were small areas of Lucky Star silt loam, 6 to 30 percent slopes, and areas of Ant Flat loam, 6 to 20 percent slopes.

This Scave soil is used for range, watershed, and wildlife habitat. It is suited to aspen, but few aspen are used except for firewood. (Capability unit VIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2o1; wildlife suitability group 4)

Scave extremely rocky silt loam, 10 to 30 percent slopes (SKE).—This mapping unit is near the Weber County line west of James Peak. About 60 percent of the mapping unit is Scave stony silt loam, 10 to 30 percent slopes; 30 percent is Rock land and rock outcrop; and 10 percent is included soils.

The Scave soil is similar to Scave silt loam, 10 to 30 percent slopes, except that it has 10 to 30 percent gravel and cobblestones and about 10 percent stones on the surface and in the surface layer. Large stones are scattered throughout the profile. The depth to the horizon of clay accumulation ranges from 28 to 32 inches. The vegetation is oakbrush, slender wheatgrass, and big sagebrush.

Rock land and rock outcrop are intermingled with areas of the Scave soil. They consist of quartzite rock.

Included in mapping were areas of Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded, and areas of steeper soils.

This mapping unit is used for range, watershed, and wildlife habitat. (Capability unit VIIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; not in a woodland suitability group; wildlife suitability group 4)

Scout Series

The Scout series consists of somewhat excessively drained soils that have a very gravelly fine sandy loam subsoil. These soils formed in residuum and till material derived from sandstone conglomerate and quartzite rocks. They are on mountain slopes at elevations of 7,200 to 8,500 feet. Slopes range from 10 to 70 percent. The vegetation is Douglas-fir, alpine fir, Engelmann spruce, and aspen. The average annual precipitation ranges from 25 to 35 inches, the mean annual air temperature is 36° to 40° F., and the mean soil temperature in summer is less than 59°. The frost-free season is 60 to 90 days. Scout soils are associated with Cluff, Curtis Creek, Hoskin, and Lucky Star soils.

In a representative profile, the surface layer is pale-brown, slightly acid gravelly light loam about 4 inches thick. The subsurface layer is pink or pinkish-gray, slightly acid gravelly light loam or gravelly fine sandy loam about 14 inches thick. The subsoil is light reddish-brown to reddish-yellow, medium acid to strongly acid gravelly fine sandy loam and very gravelly sandy loam to a depth of 60 inches or more.

Representative profile of Scout gravelly loam, 10 to 40 percent slopes, in an area of Cluff-Scout association, 6 to 40 percent slopes, about 1.6 miles east of Baxter Sawmill near the west quarter corner of sec. 36, T. 11 N., R. 4 E.:

O1&O2—2 inches to 0, coarse needles and conifer branches over dark, soft humus layers.

A1—0 to 4 inches, pale-brown (10YR 6/3) gravelly light loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; loose, very friable, nonsticky and slightly plastic; many fine, medium, and large roots; 20 percent gravel; slightly acid; abrupt, wavy boundary.

A21—4 to 11 inches, pinkish-gray (7.5YR 6/2) gravelly light loam, dark yellowish brown (10YR 3/4) when moist; weak, coarse, subangular structure that parts to fine granular structure; slightly hard, friable, nonsticky and slightly plastic; many fine, medium, and large roots; many, very fine, discontinuous, random and interstitial pores; 20 percent gravel; slightly acid; clear, wavy boundary.

A22—11 to 18 inches, pink (7.5YR 7/4) gravelly fine sandy loam, brown (7.5YR 4/4) when moist; weak, coarse, subangular blocky structure that parts to fine granular structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots and few large roots; many, very fine, discontinuous, random, interstitial pores; 25 percent gravel; medium acid; abrupt, wavy boundary.

B21—18 to 32 inches, light reddish-brown (5YR 6/4) very gravelly fine sandy loam, reddish brown (5YR 4/4) when moist; massive; loose dry and moist, nonsticky and nonplastic; common fine and medium roots and few large roots; 50 percent gravel; medium acid; abrupt, wavy boundary.

B22—32 to 62 inches, reddish-yellow (5YR 6/6) very gravelly sandy loam, yellowish red (5YR 5/8) when moist; single grain; loose dry and moist, nonsticky and nonplastic; few fine, medium, and large roots; 65 percent gravel; strongly acid.

The combined thickness of the A1, A2, and B2 horizons ranges from 30 to more than 72 inches. Coarse fragments consist of well-graded angular gravel, cobblestones, and stone-size quartzite and sandstone. Their content ranges from 15 to 50 percent in the A1 and A2 horizons and from 35 to 75 percent in the B2 horizon. The A1 horizon ranges from pale brown or brown to light brown in a hue of 10YR or 7.5YR. Texture is gravelly loam to gravelly silt loam. Reaction ranges from neutral to strongly acid. Thickness ranges from 0 to 5 inches. The A2 horizon ranges from pink or pinkish gray to pale brown or light brown in a hue of 10YR or 7.5YR. Texture ranges from gravelly light loam to gravelly fine sandy loam. Reaction ranges from strongly acid to slightly acid. Thickness ranges from 10 to 22 inches. The B2 horizon ranges from light reddish brown or reddish yellow to light brown in hues of 7.5YR and 5YR. Texture ranges from very gravelly sandy loam to very gravelly very fine sandy loam. Reaction ranges from strongly acid to slightly acid.

The permeability is moderately rapid. Runoff is medium to rapid, and the hazard of erosion is moderate to high. These soils hold 4 to 5 inches of available water to a depth of 5 feet. Roots penetrate to a depth of 5 feet or more.

Scout soils are used for woodland, range, watershed, and wildlife habitat.

In this survey area, the Scout soils are mapped only in associations with Cluff and Lucky Star soils.

Scout gravelly loam, 40 to 70 percent slopes (SLG).—This soil is on the mountain slopes in the Franklin Basin and Hyrum Dry Canyon areas. It is similar to Scout gravelly loam, 10 to 40 percent slopes, but it is steeper, it formed in parent material more influenced by quartzite rocks, and its colors are slightly more brown with hues of 7.5YR and 10YR. Quartzite bedrock is at a depth of 40 to 55 inches.

Included in mapping were small areas of Lucky Star gravelly silt loam, 30 to 60 percent slopes, small areas of Fitzgerald extremely stony loam, and small areas of very stony sand.

This Scout soil is used for woodland, wildlife habitat, watershed, and range. (Capability unit VIIe–HC, nonirrigated; High Mountain Loam (Conifer) range site; woodland suitability group 4r1; wildlife suitability group 4)

Shay Series

The Shay series consists of nearly level, somewhat poorly drained soils that have a silty clay subsoil. These soils formed in mixed calcareous alluvium derived from limestone, sandstone, and quartzite rocks. They are on flood plains of the Little Bear and Cub Rivers at elevations of 4,420 to 4,450 feet. Slopes range from 0 to 1 percent. The vegetation is saltgrass, Kentucky bluegrass, foxtail, and sedges. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 130 days. Shay soils are associated with Kirkham and Winn soils.

In a representative profile, the surface layer is dark-gray, mildly alkaline silty clay loam about 14 inches thick. The next layer is dark-gray, mildly alkaline silty clay about 16 inches thick. Below this is gray, moderately alkaline, highly stratified loam and sandy loam to a depth of 58 inches.

Shay soils are used mostly for irrigated crops and meadow pasture.

Shay silty clay loam (Sm).—This soil is mainly on the flood plains of the Little Bear and Cub Rivers. It has slopes of less than 1 percent.

Representative profile in a cultivated field, 1 mile north and ½ mile east of the Sego Milk Plant, Wellsville, 1,100 feet south and 1,200 feet east of the northeast corner of the southeast quarter of sec. 26, T. 11 N., R. 1 W.:

Ap—0 to 14 inches, dark-gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) when moist; weak, coarse, subangular blocky structure grading to moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; many medium and large roots; common fine and medium pores; moderately calcareous; mildly alkaline; clear, smooth boundary.

IIC1—14 to 30 inches, dark-gray (10YR 4/1) silty clay, black (10YR 2/1) when moist; moderate, coarse, subangular blocky structure grading to strong, fine, subangular blocky structure; very hard, very firm, sticky and plastic; common fine and medium roots; moderately calcareous; mildly alkaline; clear, smooth boundary.

IIIC2—30 to 44 inches, gray (2.5Y 5/1) loam, very dark gray (2.5Y 3/1) when moist; massive; slightly hard, friable, slightly sticky and plastic; common fine and medium roots; many fine and medium pores; moderately calcareous; mildly alkaline; clear, smooth boundary.

IVC3—44 to 58 inches, gray (2.5Y 5/1) sandy loam, very dark gray (2.5Y 3/1) when moist; massive; slightly hard, very friable, nonsticky and slightly plastic; strongly calcareous; moderately alkaline.

VC4—58 to 60 inches, coarse sand and gravel.

The A1 horizon ranges from dark gray to gray. Texture ranges from silty clay loam to light silty clay. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. The calcium carbonate equivalent ranges from 10 to 40 percent. Thickness ranges from 7 to 14 inches. The C horizon ranges from gray or very dark gray to grayish brown. Texture ranges from silty clay to heavy silty clay loam. The lower part of the C horizon is highly stratified and ranges from silt loam to sandy loam. Loamy fine sand, coarse sand, and gravel occur below a depth of 40 inches in places. Reaction ranges from mildly alkaline to strongly alkaline, and the horizon is moderately or strongly calcareous. Few faint to many, fine, distinct, reddish-brown mottles occur in the lower part of the C horizon below a depth of 30 inches in some profiles.

This soil is difficult to till, and it compacts if worked when wet. Runoff is slow, and the hazard of erosion is slight. Permeability is slow. When this soil is not frozen, it is saturated within a depth of 40 inches unless it is artificially drained. If the soil is drained, it holds 8 to 10 inches of available water to a depth of 5 feet. The depth to the water table is generally 30 to 50 inches. Roots penetrate to the water table or to the gravelly horizon.

Included in mapping were small areas of Winn silt loam and Kirkham silt loam. Also included were areas of poorly drained, sandy soils in old shallow oxbows.

This soil is used mostly for range. Only about 15 percent of the acreage is cultivated. Principal crops are small grain, alfalfa, sugar beets, corn for silage, and improved pasture. (Capability unit IIIw–25, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Sheep Creek Series

The Sheep Creek series consists of well-drained soils that have a very cobbly clay loam subsoil. Bedrock is at a depth of 20 to 40 inches. These soils formed in residuum and colluvium derived from limestone, calcareous sandstone, and quartzite. They are on south- and west-facing, slightly convex mountain slopes at elevations of 5,500 to 6,500 feet. Slopes range from 30 to 70 percent.

The vegetation is bluebunch wheatgrass, tall native bluegrass, Sandberg bluegrass, big sagebrush, bitterbrush, and yellowbrush. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature is 39° to 44° F., and the frost-free season is 90 to 100 days. Sheep Creek soils are associated with Smarts, Agassiz, Datwyler, Bickmore, Picayune, and Despain soils.

In a representative profile, the surface layer is brown, neutral cobbly loam about 7 inches thick. The subsoil is brown, neutral very cobbly light clay loam about 8 inches thick. The substratum is brown, mildly alkaline very cobbly loam about 13 inches thick. Fractured limestone is at a depth of 28 inches.

Sheep Creek soils are used for range, watershed, and wildlife habitat.

Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded (SNG2).—This soil is on the south- and west-facing, slightly convex mountain slopes in the Upper Little Bear River and Sheep Creek drainage areas above Anderson's Ranch.

Representative profile, in Three Mile Canyon south of Avon, about 1,200 feet north and 400 feet west of the southeast corner of sec. 5, T. 8 N., R. 1 E.:

A1—0 to 7 inches, brown (10YR 5/3) cobbly loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium and large roots; few, very fine, discontinuous, interstitial pores; 30 to 40 percent cobblestones; neutral; clear, smooth boundary.

B2t—7 to 15 inches, brown (7.5YR 5/3) very cobbly light clay loam, dark brown (7.5YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine and fine roots and few medium and large roots; common thin clay films in pores and on ped faces; 50 to 60 percent cobblestones; neutral; clear, smooth boundary.

Cca—15 to 28 inches, brown (10YR 5/3) very cobbly light loam, dark brown to brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; few, very fine, discontinuous, interstitial pores; 60 to 70 percent cobblestones; strongly calcareous; mildly alkaline; gradual, irregular boundary.

R—28 inches, fractured limestone bedrock that has brown very cobbly loam in cracks.

The combined thickness of the A1 and B2t horizons over the horizon of carbonate accumulation ranges from 13 to 22 inches. The depth to fractured limestone bedrock ranges from 20 to 40 inches. Coarse fragments are mainly cobblestone- and gravel-size, rounded limestone and calcareous sandstone rock fragments. Their content ranges from 15 to 50 percent in the A1 horizon and from 50 to 70 percent in the B2t horizon. The A1 horizon ranges from brown to dark brown in a hue of 10YR or 7.5YR. Texture is cobbly loam or gravelly loam to cobbly silt loam. Reaction is neutral to mildly alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness ranges from 6 to 12 inches. The B2t horizon ranges from brown to dark brown or yellowish brown in hues of 10YR and 7.5YR. Texture ranges from very cobbly clay loam to very cobbly loam or very cobbly silt loam. Reaction ranges from neutral to moderately alkaline, and the horizon is generally noncalcareous but is slightly calcareous in the lower part. Thickness ranges from 6 to 18 inches. The Cca horizon ranges from brown or light brown to reddish brown in hues of 10YR, 7.5YR, and 5YR. Texture ranges from very cobbly loam to very cobbly light clay loam or to very cobbly fine sandy loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is strongly to moderately calcareous.

Permeability is moderate. Runoff is rapid to very rapid, the hazard of erosion is high to very high, and this soil is moderately eroded. It holds 4 to 5 inches of available water above the bedrock. Rooting depth is 20 to 40 inches, but roots extend into cracks in the bedrock.

Included in mapping were small areas of Datwyler cobbly silty clay loam; Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and Despain gravelly loam, 30 to 70 percent slopes.

This Sheep Creek soil is used for range, watershed, and wildlife habitat. (Capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Sheep Creek-Agassiz association, eroded (30 to 70 percent slopes) (SOG2).—This mapping unit is in the vicinity of Dry Lake southwest of Wellsville and on the Clarkston Mountains. About 40 percent of the association is Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded; 30 percent is Agassiz rocky silt loam, 30 to 70 percent slopes, eroded; and 30 percent is included soils.

These steep and very steep soils are on south- and west-facing mountain slopes. The Sheep Creek soil is on the lower part of slopes, where the vegetation is grass and shrubs. The Agassiz soil is on convex ridges and the upper part of slopes.

Included in mapping were areas of Datwyler cobbly silt loam, 30 to 60 percent slopes, Picayune cobbly loam, 50 to 80 percent slopes, and Maughan silt loam, 30 to 60 percent slopes. Each of these soils makes up about 10 percent of the association. The Datwyler soil is in slightly concave areas, dominantly on the lower part of the slopes. The vegetation is grass and shrubs.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Sheep Creek soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Agassiz soil is in capability unit VIIs–MX3, nonirrigated; Mountain Shallow Loam range site. Neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

Sheep Creek-Despain association, eroded (30 to 70 percent slopes) (SPG2).—This mapping unit is on the eastern foothills of Clarkston Mountain. About 40 percent of the association is Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded; 30 percent is Despain gravelly loam, 30 to 70 percent slopes; and 30 percent is included soils.

The steep and very steep Sheep Creek soil has south-facing slopes. The vegetation is sagebrush and grass.

The Despain soil has short north-facing slopes. The vegetation is ninebark, snowberry, and other brush.

Included in mapping were areas of Agassiz rocky silt loam, 30 to 70 percent slopes, Bickmore gravelly silt loam, 30 to 70 percent slopes, and Elzinga silt loam, 30 to 60 percent slopes. The Agassiz soil makes up 20 percent of the association, and the Bickmore and Elzinga soils each makes up about 5 percent.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Sheep Creek soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Despain soil is in capability unit VIIe–M, nonirrigated; Mountain Loam range site. Neither soil is in a woodland suitability group; both are in wildlife suitability group 3)

Sheep Creek-Maughan association, eroded (30 to 70 percent slopes) (SRG2).—This mapping unit is west and south of Avon, east of the mountain divide. About 50 percent of the association is Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded; about 35 percent is Maughan silt loam, 30 to 60 percent slopes; and about 15 percent is included soils.

The steep and very steep Sheep Creek soil is on south-facing mountain slopes. The vegetation is sagebrush, forbs, and grass.

The steep and very steep Maughan soil is on north- and east-facing mountain slopes. The vegetation is scrubby maple, chokecherry, and an understory of forbs and grass.

Included in mapping were areas of Goring silt loam, 6 to 30 percent slopes, eroded, and Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes. The Goring soil makes up 10 percent of the association, and the Yeates Hollow soil 5 percent.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Sheep Creek soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Maughan soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. Neither is in a woodland suitability group; both soils are in wildlife suitability group 3)

Smarts Series

The Smarts series consists of well-drained soils that have a very cobbly loam subsoil. These soils have formed in alluvium and colluvium derived chiefly from sandstone, quartzite, and limestone. They are on alluvial-colluvial fans and in narrow drainageways at elevations of 5,200 to 9,000 feet. Slopes range from 10 to 30 percent. The vegetation is maple, chokecherry, scattered aspen, snowberry, big sagebrush, peavine, blue wildrye, slender wheatgrass, and bearded wheatgrass. The average annual precipitation ranges from 20 to 30 inches, the mean annual air temperature is 38° to 45° F., and the frost-free season is 80 to 110 days. Smarts soils are associated with Bickmore, Lucky Star, Despain, Elzinga, and Poleline soils.

In a representative profile, the surface layer is very dark grayish-brown, neutral silt loam and gravelly silt loam about 22 inches thick. The subsoil is brown, slightly acid very cobbly heavy loam about 27 inches thick. The substratum is brown, neutral very cobbly loam to a depth of 60 inches or more.

Smarts soils are used mainly for watershed, wildlife habitat, and limited grazing. Small areas are cultivated and are used for dryfarmed crops of alfalfa and small grain (fig. 12).

Smarts silt loam, 10 to 30 percent slopes (SSE).—This soil is on concave fans and alluvial drainage bottoms along the eastern foot slopes of the Wellsville Mountains.

Representative profile, in an area of native vegetation southwest of Mendon, 200 feet south and 200 feet west of the east quarter corner of sec. 19, T. 11 N., R. 1 W.:

O1—2½ inches to 0, undecomposed and partially decomposed maple leaves and twigs.

A11—0 to 15 inches, very dark grayish-brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure that parts to very fine granular structure; soft, friable, nonsticky and slightly plastic; many very fine roots and common coarse roots; 10 percent angular gravel; neutral; clear, smooth boundary.

A12—15 to 22 inches, very dark grayish-brown (10YR 3/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, medium to coarse, subangular blocky structure that parts to weak, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; common very fine and coarse roots; 35 percent angular cobblestones and gravel; neutral; clear, wavy boundary.

B21t—22 to 49 inches, brown (10YR 5/3) very cobbly heavy loam, dark brown (10YR 4/3) when moist; weak and moderate, medium and coarse, subangular blocky structure that parts to moderate, fine, subangular blocky structure; slightly hard, friable, sticky and plastic; common thin clay films on ped faces and in pores; common very fine to coarse roots; common very fine pores; 70 percent angular cobblestones and gravel; slightly acid; gradual, wavy boundary.

C—49 to 60 inches, brown (10YR 5/3) very cobbly loam, dark brown to brown (10YR 4/3) when moist; weak, medium, subangular blocky structure that parts to very fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common medium roots; common very fine pores; 70 percent angular cobblestones and gravel; neutral.

The A1 horizon ranges from very dark grayish brown to dark grayish brown. Texture is silt loam or loam to gravelly silt loam or gravelly loam. Reaction is neutral to slightly acid. Thickness ranges from 16 to 34 inches. The B2t horizon ranges from brown to dark brown or yellowish brown in a hue of 10YR or 7.5YR. Texture ranges from very cobbly heavy loam to very cobbly light clay loam, and thin clay films are few to common on peds and in pores. Thickness ranges from 20 to 32 inches. The C horizon ranges from brown to pale brown or grayish brown in a hue of 10YR or 7.5YR. Texture ranges from very cobbly loam to very cobbly sandy loam.

Permeability is moderate. Runoff is medium, and the hazard of erosion is moderate. This soil holds about 7.5 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet or more.

This soil is used mainly for watershed, wildlife habitat, and range. Small areas are used for nonirrigated small grain and alfalfa. (Capability unit VIe–M, nonirrigated; Mountain Loam (Shrubs) range site; not in a woodland suitability group; wildlife suitability group 3)

Smarts-Hoskin association, eroded (30 to 70 percent slopes) (STG2).—This mapping unit is on the lower part of the eastern slopes of Wellsville Mountain. About 50 percent of the association is Smarts gravelly loam, 30 to 70 percent slopes; 40 percent is Hoskin cobbly loam, 30 to 70 percent slopes, eroded; and about 10 percent is rock outcrop. Elevations range from 5,200 to 7,000 feet.

The Smarts soil is on north- and northeast-facing mountain slopes. The surface layer is 20 to 30 percent gravel and is 16 to 25 inches thick. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The vegetation is maple, ninebark, snowberry, pachistima, and grass.

The Hoskin soil is on south-facing mountain slopes. These are dominantly 60 to 70 percent. The surface layer is gravelly loam and contains less cobblestones than that of other Hoskin soils. The vegetation is sagebrush, forbs, and grass.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Smarts soil is in capability unit VIIe–MN, nonirrigated; Mountain Loam (Shrubs) range site. Hoskin soil is in capability unit VIIe–M4, nonirrigated; Mountain Stony Loam range site. Neither

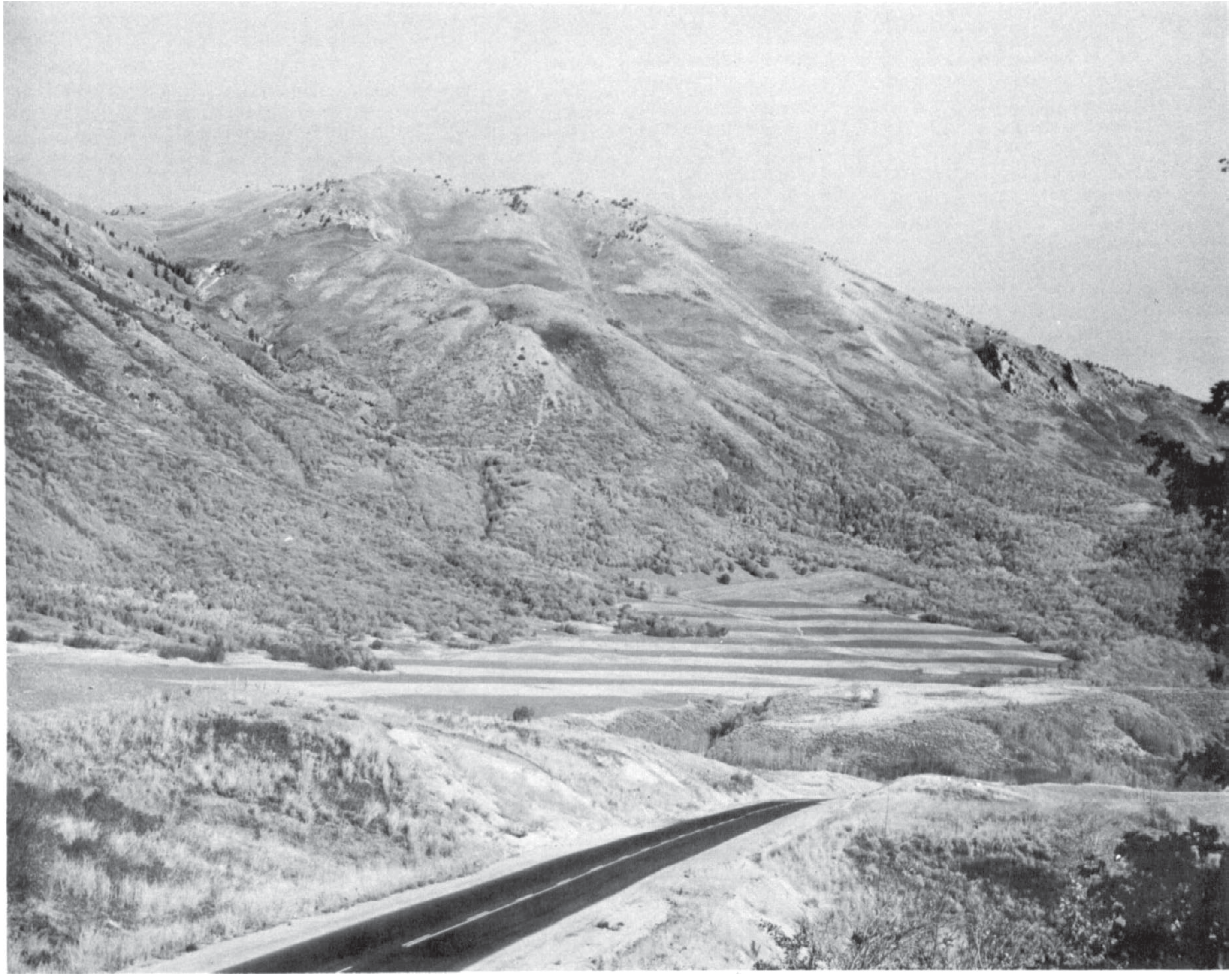

Figure 12.—Stripcropping on Smarts silt loam, 10 to 30 percent slopes. This area is in Wellsville Canyon. Wellsville Mountains are in the background.

soil is in a woodland suitability group; both are in wildlife suitability group 3)

Smarts-Lucky Star-Poleline association (30 to 70 percent slopes) (SUG).—This mapping unit is on the upper part of east-facing slopes of Wellsville Mountain. About 40 percent of the association is Smarts gravelly silt loam, 30 to 70 percent slopes; 25 percent is Lucky Star gravelly loam, 30 to 60 percent slopes; 20 percent is Poleline gravelly loam, 30 to 70 percent slopes; about 5 percent is rock outcrop; and 10 percent is included soils. Elevations range from 7,000 to 8,000 feet.

The Smarts soil has north-facing slopes. The surface layer is 20 to 30 percent gravel and is 16 to 25 inches thick. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The vegetation is maple.

The Lucky Star soil is in north-facing, concave areas at the heads of drainageways. The vegetation is apsen.

The Poleline soil is adjacent to drainageways. The vegetation is brush and shrubs.

Included in mapping were areas of Dateman cobbly silt loam, 40 to 70 percent slopes, and Agassiz silt loam, 30 to 70 percent slopes. The Dateman soil makes up 7 percent of the association, and the Agassiz soil 3 percent.

Soils of this mapping unit are used for range, watershed, and wildlife habitat. (Smarts soil is in capability unit VIIe-MN, nonirrigated; Mountain Loam (Shrubs) range site. Lucky Star soil is in capability unit VIIe-HA, nonirrigated; High Mountain Loam (Aspen) range site; woodland suitability group 2r1. Poleline soil is in capability unit VIIe-M4, nonirrigated; Mountain Stony Loam range site. Neither the Smarts soil nor the Poleline soil is in a woodland suitability group; Smarts and Poleline soils are in wildlife suitability group 3, Lucky Star soil is in wildlife suitability group 4)

Steed Series

The Steed series consists of somewhat excessively drained soils that have a very gravelly loamy sand subsoil. These soils formed in mixed alluvium derived from limestone, sandstone, and quartzite rocks. They are on alluvial fans at elevations of 4,550 to 5,700 feet. Slopes range from 0 to 10 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, big sagebrush, willow, and cottonwood. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 120 to 160 days. Steed soils are associated with Sterling, Ricks, and Winn soils.

In a representative profile, the surface layer is dark grayish-brown, mildly alkaline gravelly loam and very gravelly sandy loam about 17 inches thick. The substratum is grayish-brown, mildly alkaline very gravelly loamy sand that extends to a depth of 60 inches or more.

Steed soils are used mainly for irrigated and dryfarmed crops. Small areas are in native vegetation and are used as range.

Steed gravelly loam, 0 to 3 percent slopes (SvA).—This soil is mostly on alluvial fans and flood plains along the east side of Cache Valley.

Representative profile in a cultivated area, 1½ miles north of Richmond, 200 feet south and 200 feet east of the northwest corner of the southwest quarter of sec. 23, T. 14 N., R. 1 E.:

Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak to moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; 15 percent gravel; mildly alkaline; moderately calcareous; clear, smooth boundary.

A11—5 to 11 inches, dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure mixed with weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few fine pores; 20 percent gravel; mildly alkaline; moderately calcareous; clear, smooth boundary.

A12—11 to 17 inches, dark grayish-brown (10YR 4/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common medium roots; 65 percent gravel and cobblestones; mildly alkaline; moderately calcareous; clear, wavy boundary.

C—17 to 60 inches, grayish-brown (10YR 5/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) when moist; massive; loose, nonsticky and nonplastic; few fine roots; 80 percent gravel and cobblestones; mildly alkaline; moderately calcareous.

The A1 horizon commonly is 20 to 50 percent gravel, but in places the upper 6 to 8 inches of this horizon is slightly less than 20 percent gravel. The C horizon is more than 50 percent gravel and contains a small amount of cobblestones. In places along the Blacksmith Fork River bottom, the water table is below a depth of 45 inches. The A1 horizon ranges from dark grayish brown to grayish brown. Texture is gravelly loam to cobbly loam in the upper part of the horizon and is very gravelly sandy loam or very gravelly light loam in the lower part. Thickness ranges from 7 to 18 inches. The C horizon ranges from grayish brown to light grayish brown or pale brown. Texture is very gravelly or very cobbly loamy sand to very gravelly sandy loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. The calcium carbonate equivalent ranges from 5 to 40 percent. Common, fine and medium, faint to distinct mottles are present in places.

This soil is fairly easy to till, but gravel causes excessive wear on tillage implements. Permeability is moderately rapid. Runoff is slow, and the hazard of erosion is slight. This soil holds 3 to 3¾ inches of available water to a depth of 5 feet. Only a few roots penetrate into the very gravelly material.

Included in mapping were small areas of Stony alluvial land and small areas of Steed gravelly loam, 3 to 6 percent slopes.

This soil is used mostly for irrigated crops of small grain and alfalfa. Small areas are used for apple and pear orchards. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Steed gravelly loam, 3 to 6 percent slopes (SvB).—This soil is on alluvial fans along the east side of Cache Valley. Except for slope, it is similar to Steed gravelly loam, 0 to 3 percent slopes. The surface layer is 7 to 14 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of soils that have slopes of 6 to 10 percent.

This soil is used mostly for irrigated crops of alfalfa and small grain. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Steed gravelly loam, 6 to 10 percent slopes (SvC).—This soil is on alluvial fans at the mouth of small canyons, mainly along the east side of Cache Valley. It is similar to Steed gravelly loam, 0 to 3 percent slopes, except that it is more sloping and its surface layer is 7 to 9 inches thick. Runoff is medium, and the hazard of erosion is moderate.

This soil is used mostly for dryfarmed crops of small grain and alfalfa. Some areas are idle, but where irrigation water is available, some are used for orchards. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Sterling Series

The Sterling series consists of somewhat excessively drained soils that have a very gravelly sandy loam subsoil. These soils formed in mixed alluvium and lake sediment derived from limestone, quartzite, and sandstone. They are on medium or high lake terraces, terrace escarpments, and foothills at elevations of 4,600 to 5,500 feet. Slopes range from 6 to 50 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, cheatgrass, and big sagebrush. The average annual precipitation ranges from 15 to 17 inches, the mean annual temperature is 46° to 48° F., and the frost-free season is 130 to 160 days. Sterling soils are associated with Ricks, Timpanogos, Parleys, and Steed soils.

In a representative profile, the surface layer is dark grayish-brown, mildly alkaline gravelly loam about 16 inches thick. The substratum is pale-brown, strongly alkaline very gravelly sandy loam and brown, moderately alkaline very gravelly loamy sand that extends to a depth of 60 inches or more.

Sterling soils are used mostly for range. Some areas are used for dryfarmed crops.

Sterling gravelly loam, 10 to 20 percent slopes (SwD).—This soil is in long, narrow strips on lake terrace escarpments along the east side of Cache Valley. It is cut by a few small gullies.

Representative profile in an area of native vegetation, about ½ mile northeast of Millville, about 500 feet west and 825 feet north of the southeast corner or sec. 15, T. 11 N., R. 1 E.:

A11—0 to 9 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots and few medium roots; common fine pores; 30 percent gravel; moderately calcareous; mildly alkaline; clear, smooth boundary.

A12—9 to 16 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium roots; common fine pores; 50 percent gravel; strongly calcareous; moderately alkaline; abrupt, smooth boundary.

C1ca—16 to 27 inches, pale-brown (10YR 6/3) very gravelly sandy loam, grayish brown (10YR 5/2) when moist; massive; soft, nonsticky and nonplastic; few fine roots; 80 percent gravel; strongly calcareous; strongly alkaline.

C2—27 to 60 inches, brown (10YR 5/3) very gravelly loamy sand, brown to dark brown (10YR 4/3) moist; single grain; loose, nonsticky and nonplastic; few fine roots; 80 percent gravel; strongly calcareous; moderately alkaline.

The A1 horizon ranges from grayish brown or dark grayish brown to brown. Texture ranges from gravelly loam to gravelly heavy sandy loam that is 20 to 50 percent gravel and, in places, some cobblestones. The calcium carbonate equivalent ranges from 5 to 15 percent in the All horizon and from 15 to 40 percent in the A12 horizon. Thickness ranges from 10 to 18 inches. The Cca and C horizons range from pale brown or brown to grayish brown or light gray in a hue of 10YR or 2.5Y. They are 50 to 80 percent gravel and cobblestones, and the horizons are strongly calcareous or very strongly calcareous. The calcium carbonate equivalent ranges from 15 to 60 percent. In places the gravel is weakly cemented by carbonates.

Permeability is moderately rapid. Runoff is medium, and the hazard of erosion is moderate. This soil holds 3 to 3¾ inches of available water to a depth of 5 feet. Only a few roots extend into the very gravelly loamy sand.

Included in mapping were small areas of Timpanogos silt loam, 10 to 20 percent slopes, eroded, and small areas of soils that have slopes of 20 to 30 percent.

This Sterling soil is used mostly for range. Some areas are used for dryfarmed crops of wheat and alfalfa. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Sterling gravelly loam, 6 to 10 percent slopes (SwC).—This soil is on lake terraces, dominantly along the east side of Cache Valley between Logan and Paradise. Except for slope, it is similar to Sterling gravelly loam, 10 to 20 percent slopes. The surface layer is 14 to 20 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Timpanogos silt loam, 6 to 10 percent slopes, and areas of Sterling gravelly loam, 20 to 30 percent slopes.

This soil is used mostly for dryfarmed crops of small grain. Some small areas are irrigated by sprinklers. (Capability unit IVs–24, irrigated, VIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Sterling gravelly loam, 20 to 50 percent slopes, eroded (SwF2).—This soil is on long, narrow terrace escarpments, mainly along the east side of Cache Valley but also on the west side of the valley north of Clarkston. It is similar to Sterling gravelly loam, 10 to 20 percent slopes, but it is steeper and moderately eroded and its surface layer is 10 to 15 inches thick. In places cobblestones are on the surface and scattered throughout the profile. Runoff is rapid, and the hazard of erosion is high.

Included in mapping were small areas of Hillfield silt loam, 20 to 30 percent slopes, eroded, and areas of Sterling gravelly loam that has slopes of slightly more than 30 percent.

This soil is used mostly for range. Some areas have been cultivated in the past but are now idle. (Capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Stony Alluvial Land

Stony alluvial land (Sy) is a miscellaneous land type that consists of stony and cobbly material deposited on alluvial fans by flash floods during intensive summer thunderstorms. This land type is adjacent to very steep mountain slopes. Some areas support sparse stands of forage, but grazing is difficult because of the rough stones and cobblestones. These areas are not suited to most farm uses and are used mainly for limited grazing and wildlife habitat. (Capability unit VIIs–U4, nonirrigated; Upland Stony Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Timpanogos Series

The Timpanogos series consists of well drained and moderately well drained soils that formed in mixed lake sediment derived from limestone, sandstone, and quartzite rocks. These soils are on medium and high lake terraces at elevations of 4,450 to 5,100 feet. Slopes range from 0 to 20 percent. The vegetation is bluebunch wheatgrass, western wheatgrass, cheatgrass, gumweed, balsamroot, and big sagebrush. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 46° to 49° F., and the frost-free season is 140 to 160 days. Timpanogos soils are associated with Parleys, Ricks, Hillfield, and McMurdie soils.

In a representative profile, the surface layer is grayish-brown, mildly alkaline and moderately alkaline silt loam and loam about 9 inches thick. The subsoil is brown to dark-brown, mildly alkaline loam about 9 inches thick. The substratum is pale-brown, moderately alkaline and strongly alkaline loam and very fine sandy loam to a depth of 60 inches or more.

Timpanogos soils are used mostly for irrigated crops, but some areas are used for dryfarming, range, or community developments.

Timpanogos silt loam, 0 to 3 percent slopes (TmA).—This gently undulating soil is on medium and high lake terraces along the east side of Cache Valley.

Representative profile in a cultivated area, about 2,100 feet north and 1,200 feet east of the northeast corner of River Heights Cemetery, sec. 35, T. 12 N., R. 1 E.:

Ap1—0 to 4 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure that parts to moderate, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; noncalcareous; moderately alkaline; clear, smooth boundary.

Ap2—4 to 9 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common fine pores; noncalcareous; mildly alkaline; clear, wavy boundary.

B21t—9 to 13 inches, brown (10YR 5/3) loam, brown to dark brown (7.5YR 4/3) when moist; moderate, medium and fine, subangular blocky structure; hard, friable, sticky and plastic; common fine roots; many fine pores; common thin clay films; noncalcareous; mildly alkaline; gradual, wavy boundary.

B22tca—13 to 18 inches, brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) when moist; moderate, medium and fine, subangular blocky structure; hard, friable, sticky and plastic; common fine roots; few thin clay films; strongly calcareous; mildly alkaline; clear, smooth boundary.

C1ca—18 to 29 inches, pale-brown (10YR 6/3) loam, brown to dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; very hard, friable, slightly sticky and plastic; few fine roots; common fine pores; very strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—29 to 42 inches, pale-brown (10YR 6/3) loam, brown to dark brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; very strongly calcareous; moderately alkaline; clear, wavy boundary.

C3—42 to 60 inches, pale-brown (10YR 6/3) very fine sandy loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine pores; strongly calcareous; strongly alkaline.

The A horizon ranges from 8 to 12 inches in thickness. In places the texture ranges from silt loam to loam or very fine sandy loam. In places the horizon contains a small amount of gravel. The color ranges from grayish brown to dark grayish brown or brown in a hue of 10YR or 7.5YR. Reaction ranges from moderately alkaline to neutral, and the horizon generally is noncalcareous. In some areas, however, in the vicinity of North Logan and Providence where strongly calcareous irrigation water is used, the horizon is slightly calcareous. The B2t horizon ranges from brown to light brown or dark brown in a hue of 10YR or 7.5YR. Texture is loam or silt loam to heavy loam. Thickness ranges from 8 to 14 inches. The Cca and C horizons range from pale brown to light brownish gray or light brown in a hue of 10YR or 7.5YR. The lower part of the C horizon ranges from silt loam to loamy fine sand. The calcium carbonate equivalent ranges from 25 to 45 percent. In places the water table is at depths between 40 and 60 inches.

The soil is easy to till. It is well drained and moderately permeable. Runoff is slow, and the hazard of erosion is slight. This soil holds 10 to 12 inches of available water to a depth of 5 feet. Roots penetrate easily to a depth of 5 feet or more.

Included in mapping were small areas of Parleys silt loam, 0 to 3 percent slopes, and small areas of Ricks gravelly loam, 0 to 3 percent slopes.

This Timpanogos soil is used mostly for irrigated crops of alfalfa, small grain, beans, peas, sugar beets, corn for silage, and pasture. Some areas are used for community developments. (Capability unit IIc–2, irrigated, IIIe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Timpanogos silt loam, 3 to 6 percent slopes (TmB).—This soil is on medium and high lake terraces, dominantly along the east side of Cache Valley. It is similar to Timpanogos silt loam, 0 to 3 percent slopes, except that it is more sloping and its surface layer is 7 to 10 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Included in mapping were small areas of Ricks gravelly loam, 3 to 6 percent slopes, and a few small areas of Parleys silt loam, 3 to 6 percent slopes.

This Timpanogos soil is mostly irrigated. The principal crops are alfalfa, sugar beets, and small grain. A few acres are used for apple orchards, and some areas are used for community developments. (Capability unit IIe–2, irrigated, IIIe–U, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Timpanogos silt loam, 6 to 10 percent slopes (TmC).—This soil is on high lake terraces along the east side of Cache Valley. Except for slope, it is similar to Timpanogos silt loam, 0 to 3 percent slopes. The surface layer generally is 7 to 9 inches thick, but in places the subsoil has been exposed by tillage. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping are small areas of Hillfield silt loam with strongly calcareous surface and subsoil.

About half of the cultivated acreage is in irrigated crops of alfalfa and small grain and in apple orchards. The rest is used for dryfarmed crops of alfalfa and wheat. Some areas are used for community developments. (Capability unit IIIe–2, irrigated; IIIe–UE, nonirrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Timpanogos silt loam, 10 to 20 percent slopes, eroded (TmD2).—This soil is on long, narrow breaks that separate other Timpanogos soils of lesser slopes. It is similar to Timpanogos silt loam, 0 to 3 percent slopes, except that it is more sloping and is moderately eroded. The surface layer generally is 4 to 9 inches thick, but in cultivated areas the subsoil has been exposed in places by tillage, and the slopes are broken by a few gullies. Runoff is medium, and the hazard of erosion is moderate.

Included in mapping were small areas of Hillfield silt loam. Also included were small areas of a soil that has slopes of slightly more than 20 percent and areas of Parleys silt loam, 10 to 20 percent slopes.

About 50 percent of the acreage is used for dryfarmed crops of alfalfa and small grain. The rest consists mainly of very small areas that are idle or are in native vegetation and are used for range. (Capability unit IVe–2, irrigated, IVe–U, nonirrigated; Upland Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Timpanogos silt loam, deep water table, 0 to 3 percent slopes (TnA).—This soil is on broad, medium lake terraces, mainly in the north-central part of Cache Valley. It is similar to Timpanogos silt loam, 0 to 3 percent slopes, except that it is moderately well drained, has a fluctuating water table, and contains distinct, yellowish-red mottles at a depth of 36 to 54 inches. The surface layer is 10 to 13 inches thick. The larger areas are farther out in the valley than is typical for well-drained Timpanogos soils. Frosts in spring, caused by cold air drainage into the valley, are more likely to damage such crops as peas, corn, and sugar beets on this soil than on other Timpanogos soils.

Included in mapping were small areas of Kidman fine sandy loam, deep water table, 0 to 3 percent slopes, and small areas of soils that are slightly affected by alkali.

This Timpanogos soil is used for irrigated crops of alfalfa, sugar beets, small grain, peas, corn for silage, and for pasture. (Capability unit IIc-2, irrigated; not in a range site or a woodland suitability group; wildlife suitability group 2)

Trenton Series

The Trenton series consists of somewhat poorly drained and moderately well drained soils that have a silty clay subsoil and are affected by salt and alkali. These soils formed in mixed lake sediment derived from limestone, sandstone, and quartzite. They are on lake terraces and valley plains at elevations of 4,400 to 4,700 feet. Slopes range from 0 to 20 percent. The vegetation is saltgrass, greasewood, alkali sacaton, Great Basin wildrye, western wheatgrass, and big sagebrush. The average annual precipitation ranges from 14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 150 days. Trenton soils are associated with Jordan, Lasil, Cache, Payson, Lewiston, and Airport soils.

In a representative profile (fig. 13), the surface layer is grayish-brown, mildly alkaline silty clay loam about 8 inches thick. The subsoil is grayish-brown, mildly alkaline and moderately alkaline silty clay about 26 inches thick. The substratum is pink, moderately alkaline and strongly alkaline, strongly calcareous silty clay to a depth of 60 inches or more.

Trenton soils are used mostly for dryfarming. Some areas are irrigated, and some are in native vegetation and are used for range.

Trenton silty clay loam, 0 to 2 percent slopes (TrA).—This soil is in the north-central part of Cache Valley on low lake terraces that are broken in places by deep gullies, which serve as drainageways.

Representative profile in a cultivated area, about 2 miles west of Richmond, 600 feet west and 200 feet north of the southeast corner of the northeast quarter of sec. 29, T. 14 N., R. 1 E.:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; hard, friable, sticky and plastic; common fine and medium roots; noncalcareous; mildly alkaline; abrupt, smooth boundary.

B21t—8 to 15 inches, grayish-brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, angular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots; few fine pores; common thin clay films; slightly calcareous; mildly alkaline; clear, wavy boundary.

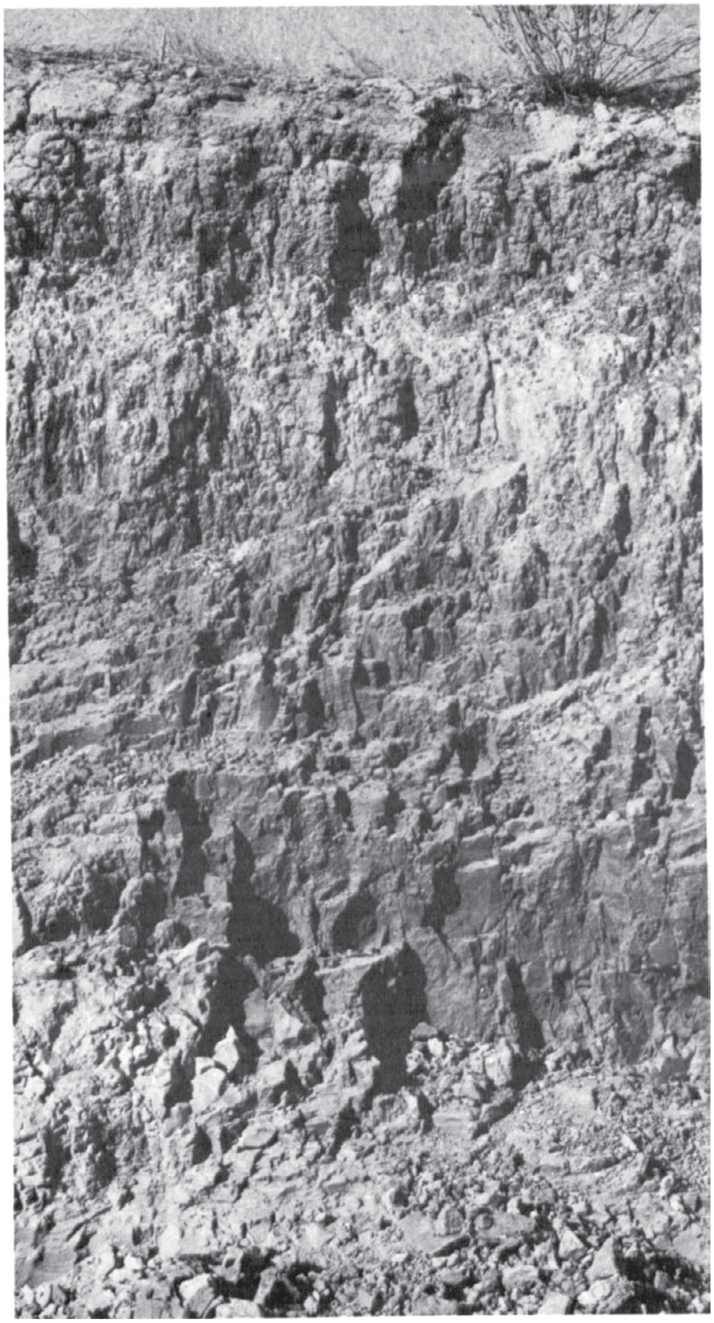

Figure 13.—**Profile of Trenton silty clay loam, 0 to 2 percent slopes.**

B22tca—15 to 26 inches, pale-brown (10YR 6/3) silty clay, brown (10YR 5/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores; common thin clay films; strongly calcareous; moderately alkaline; clear, wavy boundary.

B3ca—26 to 34 inches, pink (7.5YR 7/4) silty clay, light brown (7.5YR 6/4) when moist; moderate, coarse, prismatic structure that parts to moderate, medium, subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; few fine pores; few thin clay films; very strongly calcareous, lime is soft, laminar and veined; strongly alkaline; clear, wavy boundary.

C1ca—34 to 60 inches, pink (5YR 7/3) silty clay, reddish brown (5YR 5/3) when moist; common, fine, faint, yellowish-red (5YR 5/6) mottles; massive; extremely hard, extremely firm, very sticky and very plastic; few fine roots; strongly calcareous; moderately alkaline; gradual, smooth boundary.

C2—60 to 72 inches, pink (5YR 7/4) silty clay, reddish brown (5YR 5/3) when moist; few, fine, faint, yellowish-red (5YR 5/6) mottles; weak, coarse, prismatic structure that parts to moderate, coarse, blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; strongly calcareous; strongly alkaline.

The A horizon ranges from 7 to 10 inches in thickness. Texture is mainly silty clay loam but ranges from heavy silt loam to light silty clay. In places the horizon is slightly calcareous or moderately calcareous. Distinct, yellowish-brown to yellowish-red mottles are at a depth below 32 to 40 inches. The A1 horizon ranges from grayish brown to brown in a hue of 10YR or 7.5YR. Reaction is mildly alkaline to moderately alkaline. The B2t horizon ranges from dark grayish brown to brown in the upper part to pale brown or light brown in the lower part in a hue of 10YR or 7.5YR. Texture is dominantly silty clay but in places is clay. Reaction ranges from mildly alkaline to very strongly alkaline. The exchangeable sodium percentage ranges from 14 to 35. The B2tca and B3ca horizons are strongly calcareous or very strongly calcareous. The Cca and C horizons range from pink to very pale brown or pinkish gray in a hue of 10YR, 7.5YR, or 5YR. Texture ranges from silty clay to heavy silty clay loam, and thin strata of fine sand are present in places.

This soil is moderately difficult to till and compacts if cultivated when wet. Where it is associated with Lewiston soils, the upper 2 to 3 inches of the surface layer is fine sandy loam. This soil is moderately well drained and is slowly permeable. Runoff is slow, and the hazard of erosion is slight. This soil holds about 10 inches of water to a depth of 5 feet, but only 8 to 9 inches are available for plant use because of the salt and alkali in the lower part of the profile. The water table most commonly is below a depth of 40 inches. Most roots penetrate to a depth of about 2 feet and only a few penetrate to a depth of 3 to 4 feet.

Included in mapping were areas of Cache silty clay in low-lying areas and many areas of slickspots.

About 70 percent of the acreage is used for dryfarmed crops of alfalfa and small grain. Where irrigation water is available, alfalfa, small grain, sugar beets, corn for silage, and pasture plants are grown. (Capability unit IVw–28, irrigated, IIIs–U8, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Trenton silty clay loam, 2 to 4 percent slopes (TrB).—This soil is on low lake terraces in the north-central part of Cache Valley. It is associated with Trenton silty clay loam, 0 to 2 percent slopes, and, except for slope, is similar to that soil. Runoff is slow to medium, and the hazard of erosion is slight.

Included in mapping were small areas of Trenton soils that have a deep water table and a few small areas of a soil that has slopes of 4 to 8 percent.

This Trenton soil is used mainly for dryfarmed crops of small grain and alfalfa. Some areas are used for irrigated crops of alfalfa, small grain, corn for silage, and for pasture. (Capability unit IVw–28, irrigated, IIIs–U8, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Trenton silty clay loam, 4 to 8 percent slopes (TrC).—This soil is in small tracts at the head of gullies on low lake terraces in the north-central part of Cache Valley. It is similar to Trenton silty clay loam, 0 to 2 percent slopes, except that it is more sloping and its surface layer is 7 to 9 inches thick. In places tillage has exposed the subsoil. Runoff is medium, and the hazard of erosion is slight to moderate.

This soil is used mainly for dryfarmed crops of alfalfa and small grain. Small areas are used for irrigated crops of alfalfa and small grain and for pasture and range. (Capability unit IVw–28, irrigated, IIIs–U8, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Trenton silty clay loam, 8 to 20 percent slopes, eroded (TrD2).—This soil is generally in long, narrow tracts on the sides of gullies. It is similar to Trenton silty clay loam, 0 to 2 percent slopes, except that it is more strongly sloping and its surface layer generally is only 7 to 8 inches thick. This soil is moderately eroded. In places plowing has exposed the subsoil. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

Included in mapping were small areas of soils that have slopes of 20 to 30 percent and small areas of somewhat poorly drained Trenton soils adjacent to intermittent streams.

This Trenton soil is used chiefly for dryfarmed crops of small grain and alfalfa. Small areas are used for range. (Capability unit IVe–U8, nonirrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes (TtA).—This soil is on low lake terraces, mainly in a large area southwest of Cornish and a smaller area south of Benson. It is similar to Trenton silty clay loam, 0 to 2 percent slopes, except that the water table is between depths of 20 and 40 inches and the soil is more strongly affected by salt and alkali throughout the profile. The surface layer ranges from 8 to 15 inches in thickness and is dark brown in color. This soil is very slowly permeable.

Included in mapping were small areas of Lewiston fine sandy loam and Cache silty clay.

This Trenton soil is somewhat poorly drained. In places where it has been drained, it is used for irrigated crops of alfalfa, barley, sugar beets, corn for silage, and for improved pasture. Most areas are in native saltgrass and are used for pasture. (Capability unit IVw–28, irrigated; Alkali Bottom range site; not in a woodland suitability group; wildlife suitability group 1)

Wheelon Series

The Wheelon series consists of well-drained soils that formed in mixed lake sediment derived from tuff, tuffaceous sandstone, and limestone of the Salt Lake Formation. These soils are on rolling terraces and foothills at elevations of 4,500 to 5,300 feet. Slopes range from 10 to 70 percent. The vegetation is bluebunch wheatgrass, Indian ricegrass, prairie junegrass, balsamroot, and big sagebrush. The average annual precipitation ranges from

14 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 110 to 140 days. Wheelon soils are associated with Collinston, Mendon, Avon, Barfuss, Leatham, and LaPlatta soils.

In a representative profile, the soil is light brownish-gray to white, mildly alkaline to moderately alkaline, strongly calcareous silt loam that extends to a depth of 60 inches or more.

Wheelon soils are used for dryfarmed crops and for range.

Wheelon silt loam, 10 to 30 percent slopes (WhE).—This soil is on high lake terrace escarpments, chiefly along the west side of Cache Valley. Most slopes are short, and the soil is moderately to severely eroded.

Representative profile in a cultivated area, about 1 mile north and 2 miles west of Newton, 200 feet north and 3,000 feet west of the southeast corner of sec. 11, T. 13 N., R. 2 W.:

Ap—0 to 6 inches, light brownish-gray (2.5Y 6/2) silt loam, grayish brown to light olive brown (2.5Y 5/3) when moist; weak, medium, subangular blocky structure and weak, fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; many fine roots; few fine pores; strongly calcareous; mildly alkaline; abrupt, smooth boundary.

AC—6 to 12 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; many fine roots; few fine pores; strongly calcareous; mildly alkaline; gradual, wavy boundary.

C1ca—12 to 23 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, friable, nonsticky and nonplastic; few fine and large roots; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—23 to 43 inches, white (2.5Y 8/2) silt loam, light gray (2.5Y 7/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine roots; few fine and medium pores; strongly calcareous; moderately alkaline; gradual, wavy boundary.

C3—43 to 66 inches, white (5Y 8/2) silt loam, light olive gray (5Y 6/2) when moist; common, medium, distinct, brownish-yellow (10YR 6/6) mottles; massive; slightly hard, friable, nonsticky and nonplastic; strongly calcareous; moderately alkaline.

The A horizon ranges from light brownish gray to grayish brown or pale brown in a hue of 2.5Y or 10YR. Texture ranges from silt loam to light silty clay loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately to strongly calcareous. Thickness ranges from 6 to 16 inches. The Cca and C horizons range from white to light gray or pale yellow. Texture ranges from silt loam to very fine sandy loam or light silty clay loam. Reaction is moderately alkaline to strongly alkaline, and the horizon is strongly calcareous. Some areas of this soil have partially consolidated tuffaceous limestone and sandstone below a depth of 24 inches. In places gravel or cobblestones are scattered on as much as 5 percent of the surface and some loose gravel or cobblestones are at a depth below 40 inches.

Permeability is moderate to slow. Runoff is rapid, and the hazard of erosion is high. This soil holds 5 to 7.5 inches of available water to a depth of 5 feet. Most roots penetrate to a depth of 20 to 25 inches.

Included in mapping were small areas of Collinston loam, 10 to 30 percent slopes.

This Wheelon soil is used mainly for dryfarmed crops of alfalfa and winter wheat. Small areas are idle or are used to a limited extent for range. (Capability unit VIe–U1, nonirrigated; Upland Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Wheelon silt loam, 30 to 50 percent slopes, eroded (WhF2).—This soil is on high lake terrace escarpments and foothills surrounding Cache Valley. Runoff is very rapid, and the hazard of erosion is very high.

Included in this mapping unit were small areas of Collinston loam, 10 to 30 percent slopes.

This Wheelon soil is used as range that is grazed to a limited extent after crops on adjacent soils have been harvested. (Capability unit VIIe–U1, nonirrigated; Upland Shallow Loam range site; not in a woodland suitability group; wildlife suitability group 2)

Wheelon-Collinston complex, 10 to 30 percent slopes, eroded (WlE2).—This complex is on medium and high lake terraces surrounding Cache Valley. About 60 percent of the complex is Wheelon silt loam, 10 to 30 percent slopes, eroded, and 40 percent is Collinston loam, 10 to 30 percent slopes, eroded. The hazard of erosion is high, and these soils are moderately eroded.

The steep Wheelon soil generally is on south- and west-facing, convex knolls and ridges.

The moderately sloping and strongly sloping Collinston soil is in north- and east-facing areas between ridges and swales. Except for slope, it is similar to Collinston loam, 6 to 10 percent slopes, described under the Collinston series.

Included in mapping were small areas of gently sloping Mendon silt loam that have north-facing slopes, and small areas that are in swales.

Soils of this mapping unit are used for dryland crops of winter wheat, alfalfa, and alfalfa-grass mixtures. The soils are well suited to a permanent cover of grasses. (Both soils are in capability unit VIe–U1, nonirrigated. Wheelon soil is in Upland Shallow Loam range site; Collinston soil is in Upland Loam range site. Neither soil is in a woodland suitability group; both soils are in wildlife suitability group 2)

Winn Series

The Winn series consists of somewhat poorly drained soils that formed in mixed alluvium derived from limestone, sandstone, and quartzite. These soils are on flood plains of the Little Bear and Cub Rivers and on low lake terraces at elevations of 4,450 to 4,900 feet. Slopes range from 0 to 3 percent. The vegetation is Kentucky bluegrass, saltgrass, gumweed, willows, wild rose, sedges, and wiregrass. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 48° F., and the frost-free season is 120 to 150 days. Winn soils are associated with Kirkham, Woods Cross, and Provo soils.

In a representative profile, the soil is dark-gray to grayish-brown, mildly alkaline loam and silt loam that extends to a depth of 60 inches or more.

Winn soils are used mostly for irrigated crops. Some areas are used for range.

Winn silt loam (Wn).—This soil is on flood plains and low terraces that are dissected by old river channels. It is mostly in areas adjacent to the Little Bear and Cub River drainages. Slopes range from 0 to 3 percent.

Representative profile in a cultivated area, about 2 miles northeast of Wellsville, 1,300 feet north and 800 feet west of the southeast corner of sec. 26, T. 11 N., R. 1 W.:

A11—0 to 6 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; few fine pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

A12—6 to 13 inches, dark-gray (10YR 4/1) loam, very dark gray (10YR 3/1) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; many fine and medium roots; common medium pores; moderately calcareous; mildly alkaline; clear, wavy boundary.

AC—13 to 18 inches, dark-gray (2.5Y 4/1) loam, very dark gray (2.5Y 3/1) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; common large pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C1—18 to 40 inches, grayish-brown (10YR 5/2) loam, very dark gray (2.5Y 3/1) when moist; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and large roots; common large pores; strongly calcareous; mildly alkaline; clear, smooth boundary.

C2—40 to 60 inches, dark-gray (2.5Y 4/1) silt loam, very dark gray (2.5Y 3/1) when moist; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; hard, friable, slightly sticky and plastic; many fine and medium roots; common fine pores; moderately calcareous; mildly alkaline.

The A1 horizon ranges from dark gray to very dark gray or to dark grayish brown. Texture is silt loam to loam. Reaction is mildly alkaline to moderately alkaline, and the horizon is moderately calcareous to strongly calcareous. Thickness ranges from 12 to 20 inches. The C horizon ranges from grayish brown to dark gray, gray, or light grayish brown. Common to many, fine, distinct, brown to yellowish-brown (10YR 5/8 and 7.5YR 5/4) mottles are below a depth of 16 inches. The horizon ranges from loam to silt loam or very fine sandy loam and is somewhat stratified.

This soil is easy to till. Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. In years when runoff is high in spring, some areas are inundated for a short period. If this soil is drained, it holds 8 to 10 inches of available water to a depth of 5 feet. The depth to the water table fluctuates with the water level in the rivers, but during the growing season the water table is mainly below a depth of 30 to 50 inches. Roots penetrate to the water table easily.

Included in mapping were small areas of Provo gravelly loam in poorly drained, isolated oxbows and in channeled areas. Also included were small areas of Kirkham silt loam along the Cub River bottoms.

This Winn soil is used mostly for irrigated crops of alfalfa, small grains, sugar beets, corn for silage, and pasture. (Capability unit IIIw-2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Winn-Provo complex (Wp).—This complex is mainly on the Logan River, Blacksmith Fork, and Little Bear River flood plains. About 60 percent of the complex is Winn silt loam, moderately deep over gravel, and 40 percent is Provo loam. In years when runoff is high in spring, these soils are subject to overflow for a short period.

The Winn soil is similar to Winn silt loam, except that it has gravelly sandy loam material below a depth of 36 inches.

In places, generally on the flood plain of the Blacksmith Fork River, the Provo soil is weakly cemented by lime in the lower part of its substratum.

Included in mapping were small areas of gravelly and cobbly riverwash material and small areas of deep, poorly drained, loamy soils.

Soils of this mapping unit are used for irrigated crops of alfalfa and small grain and for native pasture. (Capability unit IIIw-2, irrigated; Semiwet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Woods Cross Series

The Woods Cross series consists of poorly drained soils that have a heavy clay loam subsoil. These soils formed in noncalcareous alluvium derived from sandstone, quartzite, and shale. They are on flood plains and low fans at elevations of 4,600 to 5,000 feet. Slopes are 0 to 3 percent. The vegetation is wiregrass, sedges, foxtail, and clover. The average annual precipitation ranges from 15 to 17 inches, the mean annual air temperature is 45° to 47° F., and the frost-free season is 120 to 140 days. Woods Cross soils are associated with Winn and Kirkham soils.

In a representative profile, the soil is very dark gray, neutral or mildly alkaline heavy silty clay loam, clay loam, and heavy clay loam to a depth of 36 inches. Below this is gray, mildly alkaline loam to a depth of 60 inches or more.

Woods Cross soils are used mostly for irrigated alfalfa and small grain and for meadow hay and native grass pasture.

Woods Cross silty clay loam (Wr).—This soil is on flood plains and low-lying alluvial fans, mainly along the Little Bear River south of the community of Avon. Slopes range from 0 to 3 percent.

Representative profile in a wet meadow pasture, about three-fourths mile south of Avon, 900 feet south and 300 feet west of the northeast corner of sec. 15, T. 9 N., R. 1 E.:

O1—2 inches to 0, matted roots and plant residue.

A11—0 to 8 inches, very dark gray (2.5Y 3/1) heavy silty clay loam, black (10YR 2/1) when moist; weak, medium and fine, granular structure; very hard, very firm, slightly sticky and plastic; common fine and medium roots; neutral; clear, smooth boundary.

A12—8 to 16 inches, dark-gray (2.5Y 4/1) clay loam, very dark gray (2.5Y 3/1) when moist; weak, fine, subangular blocky structure; very hard, very firm, slightly sticky and plastic; common fine roots and few medium roots; mildly alkaline; clear, smooth boundary.

A13—16 to 26 inches, very dark gray (2.5Y 3/1) heavy clay loam, black (2.5Y 2/1) when moist; massive; very hard, very firm, slightly sticky and plastic; common fine and medium roots; neutral; gradual, smooth boundary.

AC—26 to 36 inches, dark-gray (2.5Y 4/1) heavy clay loam, black (2.5Y 2/1) when moist; common distinct mottles; massive; extremely hard, very firm, slightly sticky and plastic; many fine roots and few medium roots; noncalcareous; mildly alkaline; clear, smooth boundary.

C1—36 to 60 inches, gray (2.5Y 5/1) loam, very dark gray (2.5Y 3/1) when moist; common distinct mottles; massive; extremely hard, firm, sticky and plastic; few medium roots; noncalcareous; mildly alkaline.

The A1 horizon has a hue of 10YR or 2.5Y. Distinct mottles are present in or immediately below this horizon. Texture ranges from heavy silty clay loam or heavy clay loam to heavy silt loam. The horizon is dominantly noncalcareous, but in places it is slightly calcareous because of overwash or the calcareous water used for irrigation. Thickness ranges from 24 to 40 inches. The C horizon ranges from gray to very dark gray, dark olive gray, or olive gray in hues of 2.5Y and 5Y. This horizon ranges from silty clay loam to loam and generally is stratified. In places gravel and sand are at a depth below 40 inches.

Permeability is slow. Runoff is slow or very slow, and the hazard of erosion is none to slight. Some areas are inundated for short periods in years of high runoff in spring. If this soil is drained, it holds 8 to 10 inches of available water to a depth of 5 feet. The depth to the water table ranges from 10 to 30 inches in undrained areas. Most roots penetrate to the water table.

About 60 percent of the acreage is in native vegetation and is used for meadow pasture and hay. The rest of the acreage is partially drained and is used for irrigated crops and small grain, alfalfa, and pasture. (Capability unit IIIw–25, irrigated; Wet Meadow range site; not in a woodland suitability group; wildlife suitability group 1)

Yeates Hollow Series

The Yeates Hollow series consists of well-drained soils that have very cobbly and stony clay subsoil. Fractured bedrock is at a depth of 40 to 60 inches. These soils formed in residuum, colluvium, and alluvium derived from quartzite and sandstone. They are on mountain slopes and fans at elevations of 5,500 to 8,000 feet. Slopes range from 3 to 70 percent. The vegetation is bluebunch wheatgrass, native bluegrass, slender wheatgrass, big sagebrush, bitterbrush, snowberry, and mulesear dock. The average annual precipitation ranges from 20 to 25 inches, the mean annual air temperature is 38° to 43° F., and the frost-free season is 80 to 110 days. Yeates Hollow soils are associated with Goring, Obray, Sheep Creek, and Datwyler soils.

In a representative profile, the surface layer is brown, neutral extremely stony silt loam about 11 inches thick. The upper part of the subsoil is brown, neutral very cobbly clay loam and brown, slightly acid very cobbly clay. The lower part of the subsoil is reddish-brown, medium acid very cobbly clay loam. Bedrock is at a depth of about 46 inches.

Yeates Hollow soils are used for range, watershed, and wildlife habitat.

Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes (YHG).—This mapping unit is mainly at the head of Little Bear River and in Blacksmith Fork Canyon. It is mainly on southern, eastern, and western exposures, but to a small extent it is on northern exposures in the mountains and on the southern exposures of steep canyons. Slopes are dominantly 40 to 65 percent. About 30 percent of the mapped areas is quartzite rock outcrop and talus. The quartzite outcrop is scattered and is mainly ledges and convex ridgetops.

Representative profile of Yeates Hollow extremely stony silt loam in an area of Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes, 1.2 miles east of the mouth of North Cottonwood Canyon in Blacksmith Fork Canyon, 600 feet south and 800 feet east of the northwest corner of sec. 16, T. 10 N., R. 3 E.:

A1—0 to 11 inches, brown (7.5YR 5/3) extremely stony silt loam, dark yellowish brown (10YR 3/4) when moist; moderate, coarse, granular structure that parts to fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few coarse roots; many, very fine, tubular and interstitial pores; 30 percent angular gravel and cobblestones and 3 percent stone; neutral; clear, wavy boundary.

B1—11 to 18 inches, brown (7.5YR 5/4) very cobbly clay loam, dark brown (7.5YR 3/4) when moist; moderate, coarse, subangular blocky structure that parts to fine subangular blocky structure; hard, very firm, sticky and plastic; common fine roots; many, very fine, tubular and interstitial pores; thin continuous clay films; 50 percent angular gravel and cobblestones; neutral; clear, wavy boundary.

B21t—18 to 33 inches, brown (7.5YR 5/4) very cobbly light clay, dark brown (7.5YR 4/4) when moist; strong, medium, subangular blocky structure; hard, extremely firm, very sticky and very plastic; few fine roots; many, very fine, tubular and interstitial pores; moderately thick continuous clay films; 65 percent angular gravel and cobblestones; slightly acid; clear, wavy boundary.

B22t—33 to 46 inches, reddish-brown (5YR 4/4) very cobbly clay loam, reddish brown (5YR 4/4) when moist; strong, medium, subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; thin continuous clay films; 65 percent angular cobblestones; medium acid.

R—46 inches, rock fragments or fractured bedrock (more than 90 percent rock).

The combined thickness of the A1, B1, and B2t horizons ranges from 40 to 60 inches or more over fractured bedrock. Coarse fragments are mixed, cobblestone-, gravel-, and stone-size sandstone and quartzite. Their content ranges from 15 to 60 percent cobblestones and gravel, and as much as 10 percent stones, in the A horizon; it ranges from 50 to 85 percent in the B horizon. The A1 horizon ranges from brown or dark grayish brown to dark brown in hues of 10YR and 7.5YR. Reaction is medium acid to neutral. Thickness ranges from 8 to 13 inches. The B1 horizon ranges from brown to reddish brown or dark brown in hues of 10YR, 7.5YR, and 5YR. Texture ranges from very cobbly clay loam or very cobbly silty clay loam to very cobbly loam. Reaction is slightly acid to neutral. Thickness ranges from 4 to 13 inches. The B2t horizon ranges from brown or reddish brown to light brown, light reddish brown, or strong brown in a hue of 7.5YR, 5YR, or 10YR. Texture ranges from very cobbly heavy sandy clay loam to very cobbly clay. Reaction ranges from strongly acid to neutral.

Permeability is slow. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. This soil holds 4 to 6 inches of available water to a depth of 5 feet. Roots penetrate to bedrock. The depth to bedrock ranges from 40 to more than 60 inches.

Included in mapping were areas of Foxol rocky loam, 30 to 60 percent slopes, which make up 5 percent of the total acreage. Also included were small areas of a soil that has slopes of 6 to 30 percent.

This Yeates Hollow soil is used for range, watershed, and wildlife habitat. (Capability unit VIIs–MX4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Yeates Hollow extremely rocky silt loam, 6 to 30 percent slopes (YHE).—This soil is on southern, western, and eastern exposures in mountainous areas. Except for slope, it is similar to Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes. The surface layer is 10 to 14 inches thick. Runoff is slow to medium, and the hazard of erosion is slight to moderate. About 25 percent of the mapped areas is quartzite rock outcrop. The outcrop is in no definite pattern, but it is commonly on slightly convex ridges. Areas of outcrop are about 2 square yards to 3 to 4 acres in size.

Included in mapping were areas of Goring silt loam, 6 to 30 percent slopes; Foxol rocky loam; and Obray silty clay, 1 to 6 percent slopes. The Goring soil makes up 6 percent of the mapped areas, the Foxol soil 3 percent, and the Obray soil 1 percent.

This Yeates Hollow soil is used for range, wildlife habitat, and watershed. (Capability unit VIIs-MX4, nonirrigated; Mountain Stony Loam range site; not in a woodland suitability group; wildlife suitability group 3)

Yeates Hollow extremely stony silty clay loam, 3 to 30 percent sopes, eroded (YLE2).—This soil is on fans and benches in the Ant Flat, Hardware Ranch, and Davenport Creek areas and west of the Little Bear River, south of Avon. It is similar to Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes, except that it is not so steep, it is moderately eroded, and rock outcrop makes up less than 2 percent of the mapped areas. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Bedrock is generally at a depth of more than 60 inches.

This soil is used for range, a source of water, and wildlife habitat. (Capability unit VIIs-MX5, nonirrigated; Mountain Stony Clay range site; not in a woodland suitability group; wildlife suitability group 3)

Use and Management of the Soils for Crops[2]

Soils differ in their suitability for farming and in the management they require for production of crops and the control of erosion. The most precise statement about soils and predictions about their use and management can best be made according to the individual soils. Some broad generalizations, however, can be made about groups of soils, and certain principles of management apply to all soils under specified kind of land use. This section of the soil survey discusses (1) general management for crops on irrigated soils, (2) general management for crops on nonirrigated soils, (3) capability of soils, and (4) crop yields.

General Management for Crops on Irrigated Soils

In the survey area, some principles of management are common to a large number of soils that are irrigated. These common management practices are discussed in the following paragraphs.

Crop selection and rotation.—The principal crops grown are alfalfa, small grain, sugar beets, corn for silage, and improved pasture. Some other crops grown to a limited extent are peas, potatoes, sweet corn, green beans, sugar beets for seed, apples, pears, sour cherries, and peaches. The production of fruit and of other crops sensitive to frost is limited to areas that have good air drainage.

Alfalfa.—Alfalfa is the most important crop and is grown on irrigated soils. Generally, alfalfa is planted with a nurse crop of small grain in the spring. Occasionally, it is planted alone or seeded in grain stubble late in August or in September. Three cuttings of alfalfa are generally made in one season. Most of the alfalfa is cut and baled. The third or fourth crop of alfalfa is commonly grazed. Occasionally, alfalfa seed is harvested from the second crop on some soils.

On almost all of the soils, alfalfa responds to phosphate fertilizer. Phosphate fertilizer is generally applied to alfalfa during the second year after seeding.

Small grain.—Barley and wheat are the principal small grains, but some oats are grown. These crops can be grown on all of the irrigated soils. Small grain is generally planted between March 15 and April 30. Winter wheat is planted from August to October. Most of the straw is baled and removed, although a considerable amount of crop residue is generally turned under. The small grain crops are generally fertilized with nitrogen. This increases the yield on most soils.

Corn.—Corn is generally planted the first year after alfalfa is plowed out. Corn is a valuable feed for cattle and grows well on most of the irrigated soils. It is usually planted from May 1 to May 10 and is harvested late in August. Most of the corn is used for silage.

Where manure is available, it is generally applied before the corn or other row crop is planted. Where manure is not available, nitrogen fertilizer is generally applied to the soil before corn is planted.

Sugar beets.—Sugar beets are the most important cash crop in the survey area. Because of nematodes, this crop is generally grown only 1 year of the crop rotation cycle. The sugar beet crop is generally planted from March 15 to April 15 and harvested early in October. Crop yields on most soils are increased by applying both nitrogen and phosphate fertilizers.

Pastures.—Improved pasture plants are grown in rotation with other crops or planted for permanent pasture. They are a suitable crop on all of the irrigated soils. Some of the steep, gravelly, and cobbly or saline and alkali soils are best suited to permanent pastures. These improved pastures consist generally of grass-legume mixtures. The kind of grass and legume grown depends on the kind of soil. Alfalfa, ladino clover, and sweetclover are commonly used as legumes. Smooth brome, tall oatgrass, alta fescue, and reed canarygrass are common grasses. Pastures are generally fertilized with nitrogen and phosphate annually.

Cropping systems.—The cropping system is variable, and the crops that are grown are determined according to the kind of soil and the location of the farm enterprise. Soil-building crops such as alfalfa or other legumes and grasses should be included in all cropping systems. These crops help counteract the soil-depleting effects of row crops and small grain. Generally, alfalfa is grown for 3 to 6 years, corn or small grain for 1 year, sugar beets for 1 year, and small grain for 1 or 2 years. Alfalfa is reseeded with the last crop of small grain. Sugar beets or corn, or both, are commonly omitted from the crop rotation system.

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[2] DONALD A. DRAGE and R. DEANE HARRISON, work unit conservationists, Soil Conservation Service, assisted in the preparation of this section.

Organic matter and fertilizer.—Organic matter consists of plant and animal residue in various stages of decomposition. The organic-matter content of the soil can be maintained or increased by adding farm manure, by turning under crop residue and green manure, and by using a cropping system that includes legumes and grasses.

Farm manure is one of the most readily available sources of organic matter. It is also an excellent fertilizer. Cow manure generally contains about 10 pounds of nitrogen and 5 pounds of phosphate per ton. Ten tons of cow manure per acre provides a good supply of plant nutrients.

Organic matter (1) improves soil structure and workability, (2) improves the water-intake rate and water-holding capacity, (3) provides a reserve of plant nutrients, (4) increases the resistance of soils to erosion, and (5) increases biological activity by providing an energy source for micro-organisms. A good soil management plan includes the addition of organic matter to the soil.

Fertilizer is used to replace the plant nutrients removed from the soil by cropping, leaching, or erosion. Nitrogen and phosphorus are the most common nutrients needed to supplement the natural supply of plant nutrients in the soils of the survey area. Most crops require nitrogen fertilizer for high yields. Legumes, such as alfalfa and clover, generally do not need nitrogen fertilizer. If crops lack nitrogen, they grow more slowly and have a light-green color. The application of fertilizer to soils used for fruit trees should be governed by the age of the tree and its terminal growth. Sugar beets, potatoes, vegetables, and alfalfa and other legumes require large amounts of phosphorous fertilizer for high yields. Grass, small grain, and corn require less phosphorus than other crops. To produce high yields of crops, most soils need an application of phosphorous fertilizer at least once in each rotation. Soil tests for phosphorus should be used as a guide in applying phosphorous fertilizer. The commercial fertilizers most used in the survey area are ammonium sulfate or ammonium nitrate for nitrogen and treble superphosphate for phosphorus.

The potassium content of soils is generally adequate for the requirement of most crops. It is possible that some of the sandy soils, such as the Preston and Layton soils, may become deficient as the potassium is depleted by crops.

In places the soil is deficient in iron and other minor elements. These deficiencies can be corrected by proper amendments.

Irrigation.—Irrigation is a means of supplying water to the soil for use by crops. Proper use of irrigation water increases suitability of the soils for crops. Too much water leaches plant nutrients from the soil and may cause erosion or excessive wetness.

All farm irrigation systems should (1) deliver the quantity of water needed to permit efficient irrigation, (2) deliver water with a minimum loss of soil, water, time, and labor, (3) provide for accurate and efficient control of water flow and measurement, (4) provide adequate disposal of waste water or runoff, and (5) be maintained easily and practically.

Several methods of irrigation provide good control of the water. Before selecting the method of irrigation, consideration should be given to the slope of the soils, the kinds of soils and their ability to absorb and hold moisture, the depth to which crop roots penetrate and the amount of water the crops need, and the amount and quality of the water supply.

Border, furrow, corrugation, contour ditch, flooding, and sprinkler methods of irrigation are commonly used in the survey area. Border and furrow irrigation are best suited to soils that have slopes of less than 3 percent. Furrows are used primarily for row crops, and borders are used for close-growing perennial crops. Corrugations are used principally for noncultivated crops where slopes are less than 10 percent. Sprinkler irrigation can be used on all soils and for all crops, but it is especially well suited to steep soils, to gravelly or sandy soils, or to soils that have not been leveled, where other irrigation methods are not practical.

Land leveling.—Leveling helps provide for better control and uniform distribution of irrigation water. A well-leveled field is one that has a smooth, uniform grade in the direction of irrigation and has only minimum side slope.

Some factors to consider before leveling are the depth and kind of soil, grade, crops to be grown, amount of irrigation water needed, size of irrigation stream, method of irrigating, field boundaries, and type of farm machinery used.

Deep cuts should not be made in fields where the soils are shallow. Soils that have a water table may require additional drainage in cut areas. Soil compaction caused by leveling equipment can be corrected by ripping, subsoiling, or fall plowing.

Where deep cuts have been made, large applications of manure and commercial fertilizer may be needed to help restore fertility. Generally, leveling in fall is preferable to leveling in spring because preparation of a good seedbed is difficult immediately after the soils are leveled in spring. Small grain or other annual crops should be planted the first year after leveling to allow for settling and to permit additional smoothing before a permanent crop is seeded.

Drainage and reclamation.—Somewhat poorly drained and poorly drained soils require artificial drainage for maximum production of cultivated crops, and restricted drainage limits the kinds of crops that can be grown. Excess water in the soil restricts the development of roots and retards the movement of air and water.

The principal purpose of drainage is to remove excess water from the soil. When the excess water is removed, aeration increases, the soil warms up sooner in spring, organic matter decays faster, nitrification takes place more rapidly, and the depth of the rooting zone is increased.

In many irrigated areas the removal of salt from the soil may be of more significance than the removal of excess water. Where salinity limits use of a soil for crops, excess water for leaching is necessary and the need for adequate drainage is increased.

The areas to be drained must be carefully studied before installing a drainage system. This study should include (1) measurements of water table depth over the area at frequent intervals throughout the year; (2) determination of the rate of movement and direction of flow of ground water; (3) estimation of the amount of water to be removed and outlet possibilities; (4) preparation of a topographic map and evaluation of the geology and physiography of the area; (5) determination of the physical and chemical properties and the behavior of the soil, including texture, permeability, rate of infiltration, and the amounts of soluble salts, exchangeable sodium, lime, and gypsum; (6) determination of the kind of crops to be grown after the soil is drained; (7) the relative cost of the drainage system.

Drainage systems are costly and commonly are difficult to install. Therefore, the practicability of making this improvement depends on the benefits that can be expected. Open ditches are commonly used to remove excess surface water and ground water from areas where tile or other types of drainage systems are impractical or too costly. Most soils of the Collett, Greenson, Kirkham, Logan, Roshe Springs, and Winn series require only drainage for high production of cultivated crops. Soils of the Airport, Trenton, and Lewiston series, however, contain harmful concentrations of salts or alkali, and some contain both. These soils require leaching irrigations, and they are likely to require a soil amendment, such as gypsum, to make them better suited to crops.

Soils affected by salt and alkali are reclaimed by obtaining adequate drainage, leveling for a uniform distribution of irrigation water, and leaching the salt and alkali from the soil by applying large quantities of irrigation water. Leveling for border or basin irrigation makes possible the most uniform distribution of water. If leaching is to be effective in removing salt and alkali from the soil, at least 10 percent or more of the water applied should be carried away in the drains. Special cropping and additions of crop residue or manure may facilitate leaching where the soil is made more permeable by crop roots or the added residue. Barley, sweetclover, tall wheatgrass, alta fescue, and reed canarygrass are adapted to wet conditions and are slightly to moderately tolerant of salt. These crops are useful in aiding the leaching process. The application of proper amounts of gypsum or sulfur generally speeds up the reclamation process.

Alkali soils have a high percentage of exchangeable sodium—more than 15 percent. This is sufficient sodium to affect the growth of most cultivated crops. The pH generally ranges from 8.5 to 10.0 unless the soils also have a high content of salt, in which case the pH is seldom higher than 8.5. Sodium has a markedly detrimental influence on the physical and chemical properties of the soil. As the proportion of exchangeable sodium increases, the soil tends to become more dispersed. Dispersed and dissolved organic matter in the soil solution may be deposited on the surface by evaporation and cause a darkening of the surface. The deposit is referred to as black alkali.

In saline soils the conductivity of the saturation extract is more than 4 millimhos per centimeter. This corresponds roughly to more than 0.2 percent soluble salt.

For many alkali soils, a soil amendment such as gypsum is needed as a source of calcium to replace the exchangeable sodium. The amount of calcium required, however, may come from irrigation water or from the soil. Alkali soils that have a high content of calcium carbonate can be treated with an acid—for example, sulfuric acid—or with an acid-forming material such as sulfur, which releases calcium to replace the excess sodium.

In the Cache Area, reclamation of the alkali-affected Lewiston soil seems to be fairly rapid without the use of amendments. Additions of gypsum or sulfur, however, help to hasten the reclamation process in the Airport, Quinney, and Trenton soils and the strongly alkali areas of Kirkham and Shay soils.

Soil analyses are needed to determine the kind and amount of amendments required for reclamation. The amount of a soil amendment needed for reclamation depends on the amount of sodium to be replaced by the amendment and the amount of amendments that can be obtained from the irrigation water or from the soil. Following the application of an amendment, leaching is necessary to distribute the dissolved calcium in the soil and to remove the excess salt. After the soils are reclaimed, one deep-leaching irrigation is needed each year to prevent further accumulation of salt or alkali.

Tillage.—Tillage should be kept to a minimum. Excessive tillage can destroy favorable soil structure and hasten depletion of the organic matter, and it tends to compact the soil. Tillage loosens the surface soil, at least temporarily, and causes loss of moisture. Crop residue should be left on the surface to help control erosion. Proper tillage is necessary for preparation of a good seedbed, to destroy weeds, to preserve good soil structure, and to help control erosion. Tilling the soil at the proper time is important. Some of the finer textured soils puddle and compact if they are worked when wet.

General Management for Crops on Nonirrigated Soils

The most important management practices on nonirrigated soils are controlling erosion, establishing a cropping system, and tilling the soils properly. Maintenance of organic matter and fertilization practices are common to both irrigated and nonirrigated soils.

Erosion control.—Water erosion is a serious hazard on many dryfarmed soils. Organic matter and plant nutrients are lost when erosion removes soil material from the surface layer. The water-intake rate is reduced, and the runoff rate and the rate of erosion are increased. The maintenance of organic matter in the soil is important in controlling erosion.

Practices that help to control erosion are stubble-mulch tillage or tilling in such a way that crop residue is kept on or near the soil surface, using grasses and legumes in the crop rotation, stripcropping fields, establishing a cover of grasses and legumes in the waterways and outlets, tilling and planting across the slope or on the contour, and diverting water than runs from higher areas.

The kind and intensity of these erosion control practices depends on the particular soil and site conditions. Generally, the erosion on soils that have slopes of 0 to 6 percent can be controlled by stubble-mulch tillage provided grasses and legumes are included in the cropping system. On the steeper soils, stubble-mulch tillage is supplemented by stripcropping, cross-slope tillage, diversions, and terraces.

Cropping systems.—A cropping system that maintains or increases the amount of organic matter in the soils is important. This helps to control erosion and to sustain high production over a long period of time. A common practice in the survey area is to alternate grain and fallow. Alfalfa and grasses are needed in rotation with grain and fallow to improve the soil structure, to help control erosion, and to keep the soils productive.

Most cropping systems need to be individually planned to fit the needs of the soil, the desires of the farmer, and the nature of the farming enterprise. A commonly used cropping system is small grain and fallow in alternate years for 6 years and then alfalfa or alfalfa and grass for 6 years. In some areas of high precipitation, the Mendon, Avon, Hendricks, and Nebeker soils are annually cropped to small grain. The principal small grain is winter wheat, but barley and spring wheat also are grown.

Tillage.—Tillage on dryfarmed soils, as on irrigated soils, should be kept to a minimum. Tillage should be limited to those practices that are necessary to prepare the seedbed and to control weeds.

The moisture content of the soil should be considered in planning tillage. If a soil is tilled when wet, compaction occurs. If the soil is tilled when too dry, it may pulverize too finely and later, upon wetting, become cloddy.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (None in the Cache Area.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils.

In the capability unit designation system used in Utah, Arabic numerals or numerals and capital letters, assigned locally, are added to the capability class and subclass designation. In the first position after the hyphen, numerals or letters refer to climatic zone; in the second position, they refer to the dominant soil and site features that influence management; in the third position (not used for some units), they refer to soil or site features that are of secondary significance in management.

Numerals are used in the first position after the hyphen for all irrigated capability units and for the nonirrigated units in the "w" subclass. Capital letters are used in this position for all other nonirrigated capability units.

Numerals and capital letters in the first position after the hyphen have meanings as follows:

2. Climatic zone that has 100 to 150 frost-free days, 12 to 20 inches of evapotranspiration, and 3,000 to 5,000 development units. A development unit is the summation of the evapotranspiration in the frost-free period expressed in centimeters multiplied by 100.

3. Climatic zone that has 70 to 100 frost-free days, 8 to 12 inches of evapotranspiration, and 2,000 to 3,000 development units.
U. Upland climatic zone, 12 to 16 inches of precipitation per year, and 9 to 14 inches of actual evapotranspiration to the soil moisture depletion date.
M. Mountain climatic zone, 16 to 22 inches of precipitation per year, and 14 to 19 inches of actual evapotranspiration to the soil moisture depletion date.
H. High Mountain climatic zone, more than 22 inches of precipitation per year.

Numerals and capital letters in the second and third positions after the hyphen have meanings as follows:

1. Historical erosion.
3. Problem or limitation caused by depth to an inhibiting layer in the soil.
4. Problem or limitation caused by low water-holding capacity attributed to gravel, cobblestones, or stones in soil material below surface layer.
5. Problem or limitation caused by slow or very slow permeability, or by poor aeration.
6. Problem or limitation caused by low water-holding capacity attributed to sandy texture of the soil.
8. Problem or limitation caused by alkali or by salts and alkali in the soil.
X. Problem or limitation caused by gravel, cobblestones, or stones on the surface of the soil.
E. Problem of erosion other than historical erosion.
C. Coniferous cover consisting of spruce and fir.
N. Maple cover.
A. Aspen cover.
Z. Actual evapotranspiration values to soil depletion date are 9 to 11 inches.

In the example IVe–MX5, nonirrigated, for the survey area, symbols have the following meanings:

IV. Capability class IV; e, subclass "e" in which the main risk is erosion; M, Mountain climatic zone; X, gravel and stones on the surface; 5, slow permeability in subsoil.

Management by capability units

In this subsection each capability unit in the survey area is described and use and management of the soils in each unit are briefly discussed. To find the names of all the soils in any given capability unit, refer to the "Guide to Mapping Units" at the back of this survey.

The capability units in class I through IV consist of soils that are well suited to irrigation and that are generally irrigated. The units in classes V through VIII consist of soils that are nonirrigated, but are used for grazing, watershed, or wildlife habitat.

CAPABILITY UNIT IIe–2, IRRIGATED

This capability unit consists of well drained and moderately well drained soils that are gently sloping and slightly undulating (slopes range from 2 to 6 percent). These soils are in the Avon, Blackrock, Crookston, Crowshaw, Hendricks, Kidman, McMurdie, Mendon, Millville, Nebeker, Parleys, Parlo, and Timpanogos series. They are on lake terraces and alluvial fans. In the areas that are not slightly undulating, the slopes are smooth.

The surface layer ranges from fine sandy loam to silty clay loam. The Blackrock soil is gravelly. Permeability of the subsoil is moderately rapid to moderately slow. These soils are generally friable and easy to till, and they absorb water readily. The silty clay loam plow layer of the Avon soil becomes slightly hard when dry, however, and it is slightly more difficult to work than the plow layer of the other soils. The available water capacity is moderately high to high. Runoff is medium to slow, and the hazard of erosion is slight to moderate. In places the Kidman and Timpanogos soils have a seasonal water table below a depth of 40 inches. The water table is generally beneficial to crops, but drainage may be required in some areas.

These soils are well suited to irrigated crops. They are used extensively for irrigated alfalfa, small grain, and improved pasture.

Land smoothing and good management of irrigation water are important practices on these soils. Obtaining uniform distribution of irrigation water is necessary. Where gravity methods of irrigation are used, intensive measures of water control are needed. Flood irrigation from contour ditches or corrugations is better for pastures and for close-growing crops than other methods of irrigation. Length of runs can range from 300 to 600 feet. These soils also are well suited to sprinkler irrigation. Rates for applying water in sprinkler irrigation range from 0.4 inch to 1.0 inch per hour.

A suitable cropping system for these soils is alfalfa or alfalfa-grass for hay or pasture for 4 or 5 years, and small grain for 2 years. Sugar beets and corn for silage can be grown occasionally in rotation with other crops. Grasses and legumes in improved pasture or meadow respond well to both nitrogen and phosphorous fertilizer.

For the soils of this unit, plowing in fall is better than plowing in spring. Crop residue should be plowed under regularly to help replenish the supply of organic matter and maintain good tilth.

CAPABILITY UNIT IIe–M, NONIRRIGATED

This capability unit consists of well-drained soils in the Avon, Hendricks, McMurdie, Mendon, and Nebeker series. These soils are nearly level to gently sloping (slopes of 0 to 6 percent), and they occur on medium and high lake terraces and alluvial fans. In general, these soils have about the same suitability for crops as those in capability units IIc–2 and IIe–2, irrigated, except that for these soils irrigation water is not available. They are in an area where the annual precipitation is 18 to 20 inches. The estimated actual evapotranspiration for the soils in this unit is 14 to 16 inches before the moisture is depleted.

The surface layer is silt loam or silty clay loam. Permeability of the subsoil is moderate to moderately slow. The soils are mainly friable and easy to till. The silty clay loam surface layer of the Avon soils is slightly more difficult to till than that of the other soils. The available water capacity is high. Runoff is medium to slow, and the erosion hazard is none to moderate.

These soils are used mainly for dryfarmed wheat and alfalfa. They are well suited to these crops.

Tilling in the fall and leaving the surface rough in winter increases the intake of water and helps to control erosion. Stubble-mulch tillage is better than other methods, for it leaves crop residue on or near the surface.

A suitable cropping system for these soils is alfalfa-grass for 6 years and wheat for 6 years. A wheat-fallow rotation also is suitable. Wheat crops respond to light applications of nitrogen if moisture is adequate in the rooting zone. Legumes respond to phosphorus.

CAPABILITY UNIT IIw-2, IRRIGATED

This capability unit consists of moderately well drained soils of the Greenson, Kirkham, Millville, and Shay series. Mainly, these soils are nearly level (0 to 3 percent slopes) and are on smooth to slightly undulating, low lake terraces, alluvial fans, and flood plains. Unless these soils are drained, the water table generally is at a depth between 30 and 40 inches. The Millville soil has a water table at a depth of slightly more than 40 inches. Some areas of the Greenson soils are moderately deep over sandy and gravelly material and have slopes of 3 to 6 percent.

Except in the Shay soil, the surface layer is loam or silt loam. Permeability of the subsoil is moderate to moderately slow. The soils are friable and easy to till, and they absorb water readily. The available water capacity is moderately high to high. Runoff is slow, and the erosion hazard is none to slight. The Shay soil has a silty clay loam surface layer that is difficult to till. It has slow permeability.

Soils of this unit are well suited to irrigated crops. Where drainage is adequate, the principal irrigated crops are alfalfa, small grain, sugar beets, and corn for silage. Improved pasture is grown in rotation on some farms. Some areas are in native vegetation and are used for grazing.

Special onsite investigation generally is needed before a drainage system is installed. Most areas of these soils have been drained, but they require maintenance of drains to control the water table. Both open-ditch and tile drains are used. About 80 feet of tile drains per acre is commonly required for adequate control of the water table. Land smoothing commonly is needed to manage irrigation water properly. For alfalfa, small grain, and pasture, the border method of irrigation is better than other methods. The length of runs should be 500 to 1,300 feet and the border width 30 to 50 feet. Furrow irrigation, using runs of 300 to 800 feet, is better for row crops than other methods. Sprinkler irrigation is well suited to these soils.

A suitable cropping system is alfalfa for 3 or 4 years, corn for silage for 1 year, and small grain for 2 years. Fertilizer generally is needed in addition to available manure and plant residue. Nitrogen or phosphorus, or both, are needed. Good tilth is easily maintained if the soils are plowed in fall, if organic matter is replenished regularly, and if the soils are not tilled or trampled when wet.

CAPABILITY UNIT IIw-26, IRRIGATED

Lewiston fine sandy loam is the only soil in this capability unit. This soil is moderately well drained and somewhat poorly drained. It has slopes of 0 to 3 percent and occurs on low lake terraces. In areas that have not been drained, the water table is mainly between depths of 20 and 40 inches.

This soil is friable and is easy to till. Permeability of the subsoil is moderately rapid, and the available water capacity is moderate. Runoff is slow to very slow, and the hazard of erosion is only slight. In places this soil is slightly to moderately affected by salts and alkali. In the past much of the acreage was subirrigated. This has caused salts and alkali to accumulate in this soil.

This soil is used mainly for irrigated alfalfa, barley, sugar beets (fig. 15), corn for silage, and improved pasture. It is well suited to these crops if it is adequately drained.

Most areas of this soil have been drained. Open-drain ditches and closed-tile drains are installed to insure the most satisfactory and most economical drainage. An average of 70 feet of tile drains per acre is adequate for controlling the level of the water table. An annual leaching irrigation generally is needed to remove excess salts and alkali. For alfalfa, small grain, and pasture, the border method of irrigation is well suited. The length of runs should be 400 to 700 feet. The furrow method of irrigation, using runs of 300 to 650 feet, is better for row crops than other methods. Sprinkler irrigation is well suited to these soils.

Considerable flexibility in cropping is possible. A suitable cropping system includes alfalfa, grass, or alfalfa-grass for hay or pasture for 4 years, corn for silage for 1 year, sugar beets for 1 year, and barley for 1 year. Fertilizer generally is needed in addition to available manure. All crops except legumes respond to phosphorus and nitrogen. Legumes respond to phosphorus.

CAPABILITY UNIT IIc-2, IRRIGATED

This capability unit consists of well-drained soils in the Avon, Crookston, Hendricks, Kidman, McMurdie, Mendon, Parleys, Parlo, and Timpanogos series. These soils have slopes of 0 to 3 percent and are on smooth to slightly undulating, medium and high lake terraces and alluvial fans.

The surface layer ranges from fine sandy loam to silty clay loam. Permeability of the subsoil ranges from moderately rapid to moderately slow. The soils are mainly friable and easy to till, and they absorb water readily. The soils that have a silty clay loam surface layer are slightly difficult to till. For most of the soils, the available water capacity is moderately high to high, but for the Parlo soil, it is moderate. Runoff is slow to medium, and the hazard of erosion is none to slight. In places the Kidman and Timpanogos soils have a seasonal water table that is below a depth of 40 inches and generally is beneficial to crops, but drainage may be required in some areas.

Soils in this unit are used mainly for irrigated crops of alfalfa, small grain, sugar beets, corn for silage (fig. 15), and improved pasture. The soils are well suited to these crops. Some areas near the town of Paradise are used for producing sugar beet seed.

Land smoothing and good management of irrigation water are important on these soils. Uniform distribution of irrigation water is necessary. The border method of irrigation is well suited to alfalfa and small grain. For row crops, the furrow method of irrigation is better than

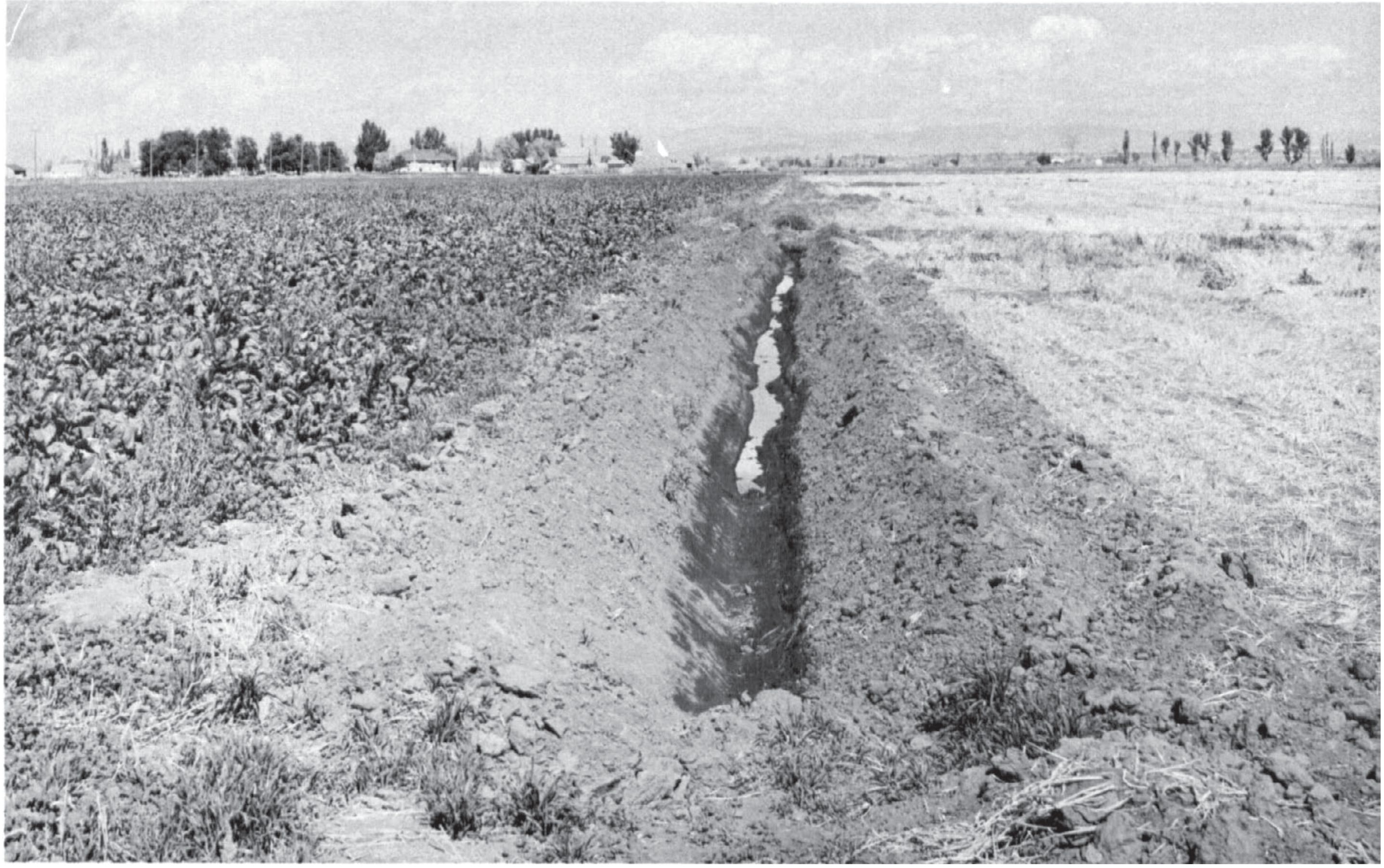

Figure 14.—Area of Lewiston fine sandy loam in capability unit II w-26, irrigated. Sugar beets are growing in the area to the left, and small grains have been harvested from the area to the right. The ditch separating the two areas is used to provide water for subirrigation.

other methods. The length of runs should be 300 to 700 feet for furrows, and 600 to 1,300 feet for borders. The width of borders should be 30 to 60 feet.

All crops that are suited to the climate can be grown on these soils. Considerable flexibility in crop rotation is possible. A suitable cropping system is 1 year of barley and alfalfa (using the barley with a new seeding of alfalfa), 3 years of alfalfa for hay, 1 year of corn for silage, and 1 year of sugar beets. All crops except legumes respond to nitrogen, and all crops respond to phosphorus.

Good tilth is easily maintained if the soils are plowed in fall, if the organic matter is replenished regularly, and if the soils are not tilled or trampled when wet.

CAPABILITY UNIT IIIe-2, IRRIGATED

This capability unit consists dominantly of well drained and moderately well drained soils in the Avon, Blackrock, Collinston, Crookston, Crowshaw, Dagor, Greenson, Hendricks, Kidman, McMurdie, Mendon, Nebeker, Parleys, and Timpanogos series. These soils have slopes of 4 to 10 percent and are on medium and high lake terraces and older alluvial fans. The erosion hazard is slight to moderate. Runoff is slow to medium. The Kidman and Greenson soils have a deep water table and may require some drainage. The Blackrock and Crowshaw soils are gravelly throughout.

Soils in this unit are used for irrigated crops of alfalfa, small grain, and improved pasture. They are not suited to row crops.

Where the gravity method of irrigation is used, intensive control of irrigation water is needed. Flood irrigation through contour ditches or corrugations is commonly used for close-growing crops. The length of runs should be 100 to 200 feet. Sprinkler irrigation is well suited to these soils.

A suitable cropping system is alfalfa-grass for hay or pasture for 4 or 5 years and barley for 2 years. All crops respond to phosphorus, and all except legumes respond to nitrogen.

CAPABILITY UNIT IIIe-M, NONIRRIGATED

This capability unit consists of well-drained soils in the Avon, Collinston, Dagor, Hendricks, McMurdie, Mendon, and Nebeker series. These gently undulating and strongly sloping soils (slopes of 6 to 10 percent) are on medium and high lake terraces and alluvial fans.

The surface layer is silt loam or silty clay loam. Generally, these soils are friable and easy to till, but those that have a surface layer of silty clay loam are fairly difficult to till. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is high. Permeability of the subsoil ranges from moderate to

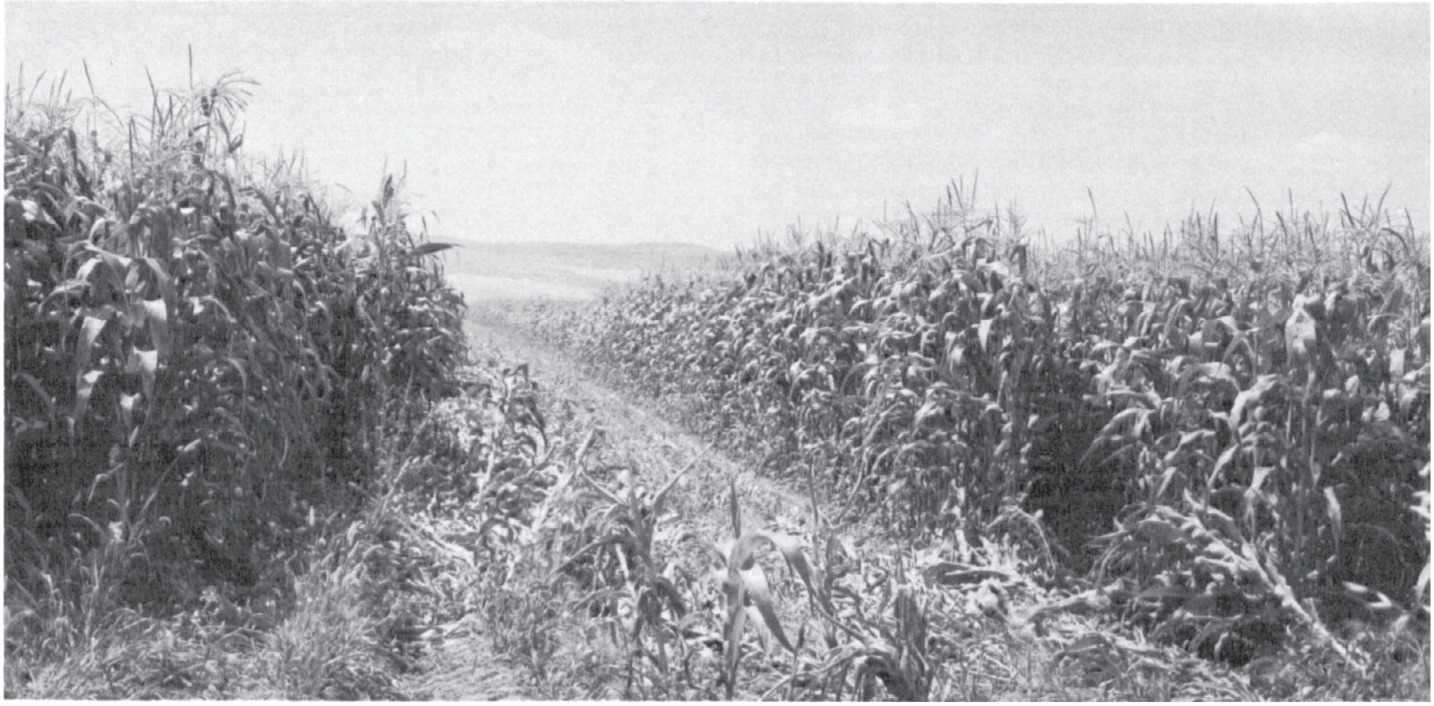

Figure 15.—**Corn for silage growing on Kidman fine sandy loam, deep water table, 0 to 2 percent slopes. This soil is in capability unit IIc–2, irrigated.**

moderately slow. Average annual precipitation is 18 to 20 inches. The estimated evapotranspiration is 14 to 16 inches before the moisture is depleted.

These soils are used for nonirrigated crops of alfalfa-grass and wheat. They are fairly well suited to wheat, barley, alfalfa, and grasses. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses.

Stubble-mulch tillage, stripcropping, contour farming, diversions, and grassed waterways conserve moisture and reduce runoff.

A suitable cropping system is alfalfa-grass hay for 6 years and fallow-winter wheat for 2 to 4 years. The wheat and fallow should be in alternate years. These soils respond to light application of nitrogen and phosphorus, especially in spring when moisture is adequate. Plowing under the last hay crop for green manure improves the soil and helps to preserve soil structure and control erosion.

CAPABILITY UNIT IIIe–MX5, NONIRRIGATED

Hiibner gravelly clay loam, 3 to 10 percent slopes, is the only soil in this capability unit. This soil is well drained and is on mountain foot slopes and high lake terraces.

This soil is moderately difficult to till because the surface layer is gravelly. Some areas are stony. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Permeability of the subsoil is slow. The available water capacity is moderate. The average annual precipitation is about 18 inches. The estimated evapotranspiration is about 14 inches before the moisture is depleted.

This soil is used for nonirrigated crops of alfalfa-grass and winter wheat. Wheat, barley, and alfalfa-grass are suitable crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses for hay or pasture. Isolated areas are used for range.

A suitable cropping system consists of wheat-fallow alternately for 5 to 6 years, then alfalfa or an alfalfa-grass mixture for hay or pasture for 4 to 6 years.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, contour farming, and grassed waterways. Special investigations are necessary to establish proper grade and intensity of these practices.

CAPABILITY UNIT IIIe–U, NONIRRIGATED

This capability unit consists of well-drained soils in the Collinston, Crookston, Mendon, Parleys, and Timpanogos series. These soils are nearly level and gently sloping (slopes of 0 to 6 percent) and are on high and medium lake terraces.

The surface layer is loam or silt loam. These soils are friable and easy to work, and they absorb moisture readily. Runoff is slow to medium, and the hazard of erosion is none to slight. The available water capacity is generally high but ranges to moderate. Permeability of the subsoil is moderate to moderately slow Average annual precipitation is 14 to 17 inches. The estimated evapotranspiration is about 12 to 14 inches before the moisture is depleted.

The soils in this unit are used for nonirrigated crops of alfalfa-grass and winter wheat. They are fairly well suited to wheat, barley, alfalfa, and grass crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in mixture with suitable grasses for hay or pasture.

Tilling in fall and leaving the surface rough increases water intake and helps control erosion. Stubble-mulch tillage is the best method of tillage because it leaves crop residue near or on the surface.

A suitable cropping system is alfalfa or alfalfa-grass for 6 years and wheat for 6 years. A wheat-fallow rotation is also suitable for these soils. Wheat crops respond to light applications of nitrogen if moisture is adequate in the root zone. Legumes respond to phosphorus.

CAPABILITY UNIT IIIe-UE, NONIRRIGATED

This capability unit consists of well-drained soils in the Crookston, Parleys, Parlo, and Timpanogos series. These soils are gently undulating and are mainly on high lake terraces and alluvial fans. Slopes range mostly from 6 to 10 percent. The Collinston soil is highly erodible and has slopes of 1 to 6 percent.

The surface layer of these soils is loam or silt loam. The soils are friable and easy to till and absorb moisture readily. Runoff is medium, and the hazard of erosion is moderate. Mainly, the soils have a moderately high to high available water capacity, but the Parleys soil has moderate available water capacity. Permeability of the subsoil is moderate to moderately slow. The average annual precipitation is 14 to 18 inches. The estimated evapotranspiration for the soils in this unit it 12 to 14 inches before the moisture is depleted.

These soils are used for nonirrigated crops of alfalfa-grass and winter wheat. Wheat, barley, alfalfa, and grasses are suitable crops. Small grain should be alternated with summer fallow because the moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses for hay or pasture.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, contour farming, diversions, and grassed waterways. Investigations and surveys are necessary to establish some of these practices.

A suitable cropping system consists of wheat and fallow alternately for 4 or 6 years, then alfalfa or an alfalfa-grass mixture for hay or pasture for 6 years. Plowing under the last hay crop for green manure improves the soil and helps to preserve the soil structure and to control erosion. Crops respond to light applications of fertilizer if moisture is adequate in spring. Small grain responds to nitrogen, and legumes respond to phosphorus.

CAPABILITY UNIT IIIe-UX, NONIRRIGATED

This capability unit consists of well-drained soils in the Blackrock, Crowshaw, and Hyrum series. These soils are gently sloping (slopes of 3 to 8 percent) and are on alluvial fans.

The surface layer is gravelly loam. These soils are fairly easy to till, but gravel causes some excessive wear on tillage implements. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderately high. Permeability of the subsoil is moderate. The average annual precipitation is 14 to 18 inches. The estimated evapotranspiration is about 11 to 12 inches before the moisture is depleted.

These soils are used mainly for dryfarmed wheat and alfalfa. They are well suited to these crops.

Tilling in fall and leaving the surface in a rough condition increases water intake and helps to control erosion. Stubble-mulch tillage is the best method of tillage because it leaves crop residue near or on the surface. A suitable cropping system is alfalfa or alfalfa and grasses for 8 years and wheat and fallow in alternate years for 6 years.

CAPABILITY UNIT IIIe-UXE, NONIRRIGATED

This capability unit consists of well-drained soils in the Blackrock and Crowshaw series. These soils have slopes of 6 to 10 percent and are on alluvial fans and medium lake terraces.

The surface layer of these soils is gravelly loam. The soils are fairly easy to till, but gravel causes excessive wear on tillage implements. Runoff is medium, and the hazard of erosion is moderate. Permeability of the subsoil is moderate. The average annual precipitation is 14 to 18 inches. The estimated evapotranspiration for soils of this unit is 11 to 12 inches before the moisture is depleted.

These soils are used mainly for nonirrigated crops of alfalfa, alfalfa-grass hay, pasture, and winter wheat. They are fairly well suited to these crops. The small grain crops are alternated with fallow.

Practices that conserve moisture and reduce runoff are stubble mulching, contour farming, stripcropping, and growing grasses and legumes in rotation.

A suitable cropping system is alfalfa-grass hay or pasture for about 6 years and wheat and fallow in alternate years for 2 to 4 years. These soils respond to small applications of fertilizer if adequate moisture is available.

CAPABILITY UNIT IIIw-2, IRRIGATED

This capability unit consists of somewhat poorly drained and poorly drained soils in the Nibley, Provo, Roshe Springs, and Winn series. These soils mainly have slopes of 0 to 3 percent, but the Nibley soil has slopes of 3 to 6 percent. They are on broad, low lake terraces and river flood plains. The depth to the water table in undrained areas ranges from 28 to 40 inches.

The surface layer of these soils is silty clay loam or silt loam. The soils that have a silty clay loam surface layer are fairly difficult to till, but those that have a silt loam surface layer are easy to till. The available water capacity is chiefly moderate to high, but the Provo soil has moderately low available water capacity. Runoff is slow to very slow, and the hazard of erosion is none to slight. Permeability of the subsoil ranges mostly from slow to moderate, but the Provo soil is gravelly below a depth of about 13 to 27 inches and its permeability is moderately rapid to rapid.

Most areas of these soils are drained and are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage. If these soils are drained, they are fairly well suited to these crops. The undrained areas are used for native pasture. Only about 25 percent of the acreage of Roshe Springs and Provo soils has been drained.

Open ditches and tile drains are used to control the water table below the root zone of alfalfa and other deep-rooted crops. For the best and most economical placement of drains, investigations generally are needed before drains are installed. Land smoothing is necessary to obtain uniform distribution of irrigation water in some areas. The border method of irrigation is best for alfalfa, small grain, and other close-growing crops. The length of runs can range from 900 to 1,320 feet. Furrow irrigation is best for row crops where runs range from 600 to 900 feet.

A suitable cropping system is alfalfa-grass hay for 3 years, corn for silage for 1 year, sugar beets for 1 year, and barley for 1 or 2 years. All crops respond to phosphorus, and all crops except legumes respond to nitrogen.

Good tilth can be maintained if the soils are plowed in fall and if organic matter is replenished regularly by manure and crop residue. Tillage and grazing should be avoided when the soils are wet.

CAPABILITY UNIT IIIw-25, IRRIGATED

This capability unit consists of somewhat poorly drained soils in the Cardon, Collett, Greenson, Logan, Salt Lake, Shay, and Woods Cross series. These soils are nearly level (slopes of 0 to 3 percent) and are on smooth to slightly undulating, low lake terraces, river flood plains, and alluvial fans.

The surface layer generally is silt loam or silty clay loam, but the Cardon soil has a silty clay surface layer. The soils that have a silty clay loam or silty clay surface layer are difficult to till, but those that have a silt loam surface layer are easy to till. Some areas are slightly affected by salt and alkali. Runoff is slow to ponded, and the hazard of erosion is none to slight. The available water capacity is moderately high to high. The permeability of the subsoil ranges from moderate to slow. The depth to the water table in undrained areas ranges mainly from 10 to 40 inches.

Most areas of these soils are used for native pasture or hay. Some areas have been drained and are used for cultivated crops of small grain and alfalfa and for improved pasture.

Open ditches and tile drains are used to control the water table below the root zone of alfalfa and other deep-rooted crops. For the best and most economical placement of drains, investigations generally are needed before drains are installed. Land smoothing is necessary to obtain a uniform distribution of irrigation water in some areas. The border method of irrigation is best for alfalfa, small grain, and other close-growing crops.

A suitable cropping system is alfalfa-grass hay for 3 years, corn for silage for 1 year, sugar beets for 1 year, and barley for 1 or 2 years. All crops respond to phosphorus, and all crops except legumes respond to nitrogen.

Good tilth can be maintained if the soils are plowed in fall and if organic matter is replenished regularly by manure and crop residue. Tillage and grazing should be avoided when the soils are wet.

CAPABILITY UNIT IIIw-28, IRRIGATED

Quinney silt loam is the only soil in this capability unit. This soil is moderately well drained and somewhat poorly drained and is strongly affected by alkali. It is slightly undulating (slopes of 0 to 3 percent) and is on low lake terraces and flood plains.

The surface layer generally is silt loam, but in small areas it is fine sandy loam. Where the surface layer is fine sandy loam, the soil is easy to till. The surface layer is slightly to moderately affected by salt and alkali, and the subsoil and substratum are strongly to very strongly affected by alkali. Runoff is slow, and the hazard of erosion is slight to none. The available water capacity is moderately high. Permeability of the subsoil is moderate to moderately slow. The depth to the water table in undrained areas ranges mainly from 30 to 50 inches.

Undrained areas of this soil are used mainly for native pasture or hay. Small areas have been drained and are used for irrigated crops of small grain and alfalfa and for improved pasture. Sugar beets and corn for silage also are grown.

Open ditches and tile drains are used to control the water table below the root zone of deep-rooted crops. For the best and most economical placement of drains, investigations generally are needed before drains are installed. Following drainage, reclamation is necessary. Large applications of manure and some amendments of gymsum or sulfur are generally needed to reclaim this soil. Land smoothing is needed to obtain a uniform distribution of irrigation water in some areas. The border method of irrigation is the best for close-growing crops. Furrow irrigation is best for row crops. A suitable cropping system is alfalfa-grass hay for 3 years, corn for silage 1 year, sugar beets for 1 year, and barley for 1 or 2 years.

CAPABILITY UNIT IIIw-3, IRRIGATED

Center Creek silt loam is the only soil in this capability unit. This soil is somewhat poorly drained. It has slopes 1 to 3 percent and is on broad, low lake bottoms.

The surface layer is silt loam and is easy to till. Runoff is slow to very slow, and the hazard of erosion is none to slight. The available water capacity is high. Permeability of the subsoil is moderately slow. The depth to the water table fluctuates considerably but ranges from a depth of 28 to 40 inches during most of the growing season.

The soil is used for alfalfa, small grain, and native pasture. It is fairly well suited to those crops.

Controlling the water table and good management of water are important.

Good tilth can be maintained if the soil is plowed in fall and if organic matter is replenished regularly by manure and crop residue. Tillage and grazing should be avoided when the soil is wet.

CAPABILITY UNIT IIIs-24, IRRIGATED

This capability unit consists of well drained and moderately well drained soils in the Collinston and Layton series. These soils have slopes of 0 to 3 percent and are on smooth to slightly undulating, medium lake terraces.

The surface layer of these soils is loamy fine sand. The soils are very friable and easy to till, and they absorb water readily. Runoff is slow, and the hazard of erosion is slight. The available water capacity is moderately low. Permeability of the subsoil is rapid. Unless the Layton soil is drained, the water table is mainly at a depth of 36 to 45 inches during the irrigation season.

These soils are used for irrigated crops of alfalfa, small grain, sugar beets, and corn for silage.

Careful control of irrigation water is very important. Some areas may require drains. Land smoothing is needed in some areas unless they are sprinkler irrigated. The border method of irrigation is suitable for close-growing crops. The length of runs ranges from 300 to 600 feet. Where row crops are grown, the furrow method is well suited and runs can range from 250 to 500 feet. The soils are well suited to sprinkler irrigation. The rate of water application can range from 0.7 to 1.5 inches per hour.

A suitable cropping system is grass-legume hay or pasture for 4 or 5 years, corn for 1 year, sugar beets for 1 year, and small grain for 1 or 2 years. All crops except legumes respond to nitrogen. All crops respond to phosphorus.

Plowing can be done either in spring or in fall. Good tilth is easily maintained if organic matter is replenished regularly by additions of manure and crop residue.

CAPABILITY UNIT IIIs-25, IRRIGATED

Battle Creek silty clay loam, 0 to 2 percent slopes, is the only soil in this capability unit. This soil is well drained. It is on lake terraces.

The surface layer is silty clay loam, and the soil is moderately difficult to till. It compacts if tilled when wet. Runoff is slow, and the hazard of erosion is none to slight. The available water capacity is high. The subsoil has slow permeability.

This soil is well suited to irrigated crops of alfalfa, small grain, corn for silage, and for improved pasture. It is only fairly well suited to sugar beets.

In some areas land smoothing is needed for uniform distribution of water to all parts of the field. Sprinkler irrigation is used in many areas and is better suited to these soils than other methods. Border irrigation can be used for close-growing crops, and the length of runs can range from 1,000 to 1,300 feet. Furrow irrigation can be used, and runs can range from 500 to 1,100 feet. The surface layer is compacted if it is tilled or plowed when wet. Plowing in fall and proper timing of operations in spring are necessary to avoid compaction. A suitable cropping system is alfalfa for 3 years, corn for silage for 1 year, and small grain for 1 or 2 years. Crops respond to nitrogen, phosphorus, or both, depending on the crop and the cropping history.

CAPABILITY UNIT IIIs-U4, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils in the Collinston and Parlo series. These soils are nearly level to gently sloping (slopes of 0 to 6 percent) and are on medium lake terraces. The Parlo soils are 28 to 40 inches deep over gravel and sand.

The surface layer of the soils in this unit ranges from loamy fine sand to silt loam. The soils are friable and easy to till. Runoff is very slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderate. Permeability of the subsoil ranges from moderate to rapid. Average annual precipitation is 14 to 18 inches. The estimated evapotranspiration is 12 to 14 inches before the moisture is depleted.

These soils are used mainly for nonirrigated crops of alfalfa-grass and winter wheat. Wheat, barley, alfalfa, and grasses are suitable crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture of suitable grasses for hay or pasture.

Tilling in fall and leaving the surface in a rough condition increases water intake and helps to control erosion. Stubble-mulch tillage is better than other methods because it leaves crop residue near or on the surface. A suitable cropping system is alfalfa or alfalfa-grass for 8 years and wheat alternated with fallow for 6 years. Wheat responds to light applications of nitrogen if moisture is adequate in the root zone. Legumes respond to phosphorus.

CAPABILITY UNIT IIIs-U5, NONIRRIGATED

Battle Creek silty clay loam, 0 to 2 percent slopes, is the only soil in this capability unit. This soil is well drained. It is on gently undulating, medium lake terraces.

The surface layer is a silty clay loam. The soil is moderately difficult to till and compacts if tilled when wet. Runoff is slow, and the hazard of erosion is none to slight. The available water capacity is high. Permeability of the subsoil is slow. Average annual precipitation is 14 to 17 inches. The estimated evapotranspiration is 12 to 14 inches before the moisture is depleted.

This soil is used mainly for nonirrigated crops of alfalfa and small grain. It is fairly well suited to these crops.

Tilling in fall and leaving the surface in a rough condition increases water intake and helps to control erosion. Stubble-mulch tillage is better than other methods because it leaves crop residue near the surface. A suitable cropping system is alfalfa or alfalfa and grasses for 8 years and wheat and fallow in alternate years for 8 years.

CAPABILITY UNIT IIIs-U8, NONIRRIGATED

This capability unit consists of moderately well drained soils of the Trenton series that are affected by alkali. These soils have slopes of 0 to 8 percent and are on low lake terraces.

The surface layer of these soils is silty clay loam. Generally, the surface layer only is slightly affected by alkali, but the subsoil and substratum are strongly affected. The soils are fairly difficult to till except at optimum moisture content. Runoff is slow, and the hazard of erosion is slight. The available water capacity is moderately high. Permeability of the subsoil is slow. The water table is below a depth of 40 inches. Average annual precipitation is 14 to 17 inches. The estimated evapotranspiration is 11 to 12 inches before the moisture is depleted.

These soils are used mainly for dryfarmed crops. Wheat, barley, alfalfa, and grass are suitable crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses for hay or pasture.

The management practices for moisture conservation include selection of crops and rotations that are suited to the moisture supply.

A suitable cropping system is alfalfa or alfalfa-grass for 6 years and small grain and fallow in alternate years for 6 years. Stubble-mulch tillage is better than other methods because it leaves crop residue on the surface. Crops generally respond to small amounts of nitrogen, phosphorus, or both, depending on the availability of adequate moisture.

CAPABILITY UNIT IVe-2, IRRIGATED

This capability unit consists of well-drained soils in the Avon, Battle Creek, Dagor, Hendricks, Kidman, and Timpanogos series. These soils have slopes of 8 to 20 percent and are on alluvial fans and medium and high lake terraces.

The surface layer ranges from fine sandy loam to silty clay loam. The soils that have a silty clay loam surface layer are slightly difficult to till, but the other soils are friable and easy to till. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The available water capacity is moderately high to high. Permeability of the subsoil ranges from moderately rapid to moderately slow.

These soils are used mainly for irrigated crops of alfalfa, small grain, and improved pasture. They are not suited to row crops. Where these soils are irrigated, intensive practices must be used to control erosion.

Sprinkler irrigation is better suited than other methods. The slopes are too steep for the gravity method of irrigation except for furrow irrigation on the contour or across the slope.

CAPABILITY UNIT IVe-M, NONIRRIGATED

This capability unit consists of well-drained soils in the Avon, Collinston, Dagor, Hendricks, McMurdie, and Nebeker series. These soils have slopes of 10 to 20 percent and are on lake terraces and alluvial fans.

The surface layer of these soils is silt loam or silty clay loam. The soils are mainly fairly easy to till, but those that have a silty clay loam surface layer are slightly difficult to till except at optimum moisture content. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is high. Permeability of the subsoil is moderate or moderately slow. Average annual precipitation is 18 to 20 inches. The estimated evapotranspiration is 14 to 16 inches before the moisture is depleted.

These soils are used mainly for nonirrigated crops of alfalfa-grass and winter wheat. They are fairly well suited to these crops.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, contour farming, and constructing diversions and grassed waterways. Surveys are necessary to establish these practices. A suitable cropping system is alfalfa-grass hay or pasture for 6 years and winter wheat and fallow for 2 to 4 years.

CAPABILITY UNIT IVe-MX5, NONIRRIGATED

Hiibner gravelly clay loam, 10 to 20 percent slopes, is the only soil in this capability unit. This soil is well drained. It is on foot slopes of mountains and high lake terraces.

Some areas of this soil are stony. Fertility is moderate. The soil is moderately difficult to till because of the gravel and cobblestones. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is moderate. Average annual precipitation is 18 to 20 inches. The estimated evapotranspiration is about 14 inches before the moisture is depleted.

This soil is mainly used for range, but it is fairly well suited to an occasional dryfarmed crop. Alfalfa, wheat, and barley are suitable crops.

Practices that conserve moisture and reduce runoff include stubble mulching, stripcropping, contour farming, diversions, and grassed waterways. Investigations are necessary to establish most of these practices. A suitable cropping system is alfalfa-grass hay or pasture for 6 years and winter wheat and fallow for 2 to 4 years.

CAPABILITY UNIT IVe-U, NONIRRIGATED

This capability unit consists of well-drained soils of the Collinston and Timpanogos series. These soils are mainly moderately steep (slopes of 10 to 20 percent) and are on alluvial fans and medium lake terraces. The Collinston soil is highly erodible. It is strongly sloping (slopes of 6 to 10 percent) and generally rolling.

These soils are friable and easy to till. Runoff is medium, and the hazard of erosion is moderate. The soils have a high to moderately high available water capacity. Permeability is moderate. Average annual precipitation is 14 to 18 inches. The estimated evapotranspiration is 12 to 14 inches before the moisture is depleted.

The soils in this unit are used mainly for dryfarmed crops. Wheat, barley, alfalfa, and grass are suitable crops. Small grain should be alternated with summer fallow because moisture is limited. Alfalfa can be grown alone or in a mixture with suitable grasses for hay or pasture. A suitable cropping system is alfalfa or alfalfa-grass for 8 years and grain and fallow in alternate years for 2 to 4 years.

Tillage practices that leave crop residue on the surface are desirable. Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, contour farming, and constructing diversions and grassed waterways. Special investigations generally are necessary to establish these practices.

CAPABILITY UNIT IVe-U5, NONIRRIGATED

Battle Creek silty clay loam, 8 to 15 percent slopes, is the only soil in this capability unit. This soil is well drained. It is on lake terraces.

This soil is moderately difficult to till. The surface layer is silty clay loam. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is high. Permeability of the subsoil is slow. Average annual precipitation is 12 to 14 inches. The estimated evapotranspiration is 12 to 14 inches before the moisture is depleted.

This soil is used mainly for nonirrigated crops of alfalfa, alfalfa-grass for hay, winter wheat, and pasture. It is fairly well suited to these crops, but should be kept in permanent cover most of the time.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, and growing of grasses and legumes in rotation.

CAPABILITY UNIT IVe-U8, NONIRRIGATED

Trenton silty clay loam, 8 to 20 percent slopes, eroded, is the only soil in this capability unit. This soil is moderately well drained and is alkali affected. It is on long, narrow, low lake terrace escarpments and is moderately eroded.

This soil is fairly difficult to till. The surface layer is silty clay loam. Generally, the surface layer is only slightly affected by alkali, but the subsoil and substratum are affected by salts and alkali. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The available water capacity is moderately high. The subsoil permeability is slow. Generally, the water table is below a depth of 40 inches. Average annual precipitation is 14 to 17 inches. The estimated evapotranspiration is 11 to 12 inches before the moisture is depleted.

This soil is used for range and for dryfarmed crops of alfalfa and small grain. Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, and growing of grasses and legumes in rotation.

CAPABILITY UNIT IVe-UX, NONIRRIGATED

This capability unit consists of well-drained soils in the Blackrock, Crowshaw, and Hyrum series. These soils have slopes of 10 to 25 percent and are on alluvial fans and medium lake terraces.

The surface layer of these soils is a gravelly loam. The soils are friable and fairly easy to till, but the gravel causes excessive wear on tillage implements. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The available water capacity is moderate to moderately high. Permeability of the subsoil is moderate. Average annual precipitation is 14 to 18 inches. The estimated evapotranspiration is 10 to 12 inches before the moisture is depleted.

These soils are used mainly for dryfarmed crops of alfalfa, wheat, and barley. They are fairly well suited to these crops.

Practices that conserve moisture and reduce runoff are stubble mulching, stripcropping, and growing grass and legume in rotation. A suitable cropping system is alfalfa-grass hay or pasture for 6 to 8 years and wheat and fallow in alternate years for 2 or 3 years.

CAPABILITY UNIT IVw-28, IRRIGATED

This capability unit consists of somewhat poorly drained soils that are affected by alkali. These soils are in the Airport, Kirkham, Lewiston, Salt Lake, Shay, and Trenton series. They have slopes mainly of 0 to 4 percent, but one of the Trenton soils is on low lake terraces and has slopes of 4 to 8 percent.

The surface layer of these soils is silty clay, silty clay loam, silt loam, or fine sandy loam. The Airport, Salt Lake, Shay, and Trenton soils are fairly difficult to till because of their silty clay loam or silty clay surface layer. The surface layer of all the soils generally is only slightly affected by alkali, but the subsoil and substratum are moderately to strongly affected. Runoff is slow to ponded, and the hazard of erosion is only slight. The available water capacity is moderate to moderately high. Permeability of the subsoil is very slow to moderately rapid. The water table generally is at a depth of 20 to 40 inches.

If these soils are drained and partially reclaimed, they are suited to irrigated barley for improved pasture, but most areas are used for unimproved pasture.

Investigations are necessary to determine the feasibility of improving drainage because the soils commonly are in low areas that have limited outlets. After drainage, applications of gypsum and manure help to speed reclamation, and an application at least once each year helps to keep the salt concentration from increasing in the root zone. Land smoothing is necessary in some areas to obtain a uniform distribution of irrigation water. Border irrigation is better than other methods of surface irrigation, and the length of runs can range from 600 to 1,000 feet. Sprinkler irrigation is an alternate method. Deep cuts should be avoided when leveling to prevent exposing the saline and alkali subsoil.

A suitable cropping system for these soils is a grass-legume mixture for hay or pasture for 4 to 6 years followed by barley for 1 or 2 years. All crops should be species that are tolerant of salt and alkali. Fertilizer generally is needed.

CAPABILITY UNIT IVs-24, IRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils in the Green Canyon, Lakewin, Preston, Ricks, Steed, and Sterling series. These soils generally have slopes of 0 to 10 percent, but one of the Sterling soils has slopes of 10 to 20 percent. Soils in this unit are on alluvial fans and medium lake terraces.

The surface layer is chiefly a gravelly loam, but the Preston soil has a surface layer of fine sand and is highly susceptible to blowing. All the soils are fairly easy to till, but gravel causes excessive wear on tillage implements. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderately low to low.

These soils are used mainly for irrigated alfalfa and small grain, but fruit trees are grown in areas where good air movement reduces the hazard of damage from frost. These soils are fairly well suited to these crops.

Some areas need land smoothing, where surface irrigation methods are used. Deep cuts should be avoided in land leveling, as the very gravelly underlying material may be exposed. Sprinkler irrigation is better than other methods on these soils.

A suitable cropping system is 4 to 6 years of a grass-legume mixture for hay or pasture and 2 years of small grain. Good tilth can be maintained if the soils are plowed in fall, if organic matter is replenished regularly, and if the soils are not tilled or plowed when wet. The crops respond to frequent application of nitrogen, phosphorus, or both.

CAPABILITY UNIT Vw-2, NONIRRIGATED

This capability unit consists of somewhat poorly and poorly drained soils in the Provo, Roshe Springs, Salt Lake, and Trenton series and Mixed alluvial land. These soils have slopes of 0 to 1 percent and are on stream bottoms and flood plains in depressional areas.

The surface layer ranges from silt loam to fine sandy loam or silty clay. Runoff is slow to ponded, and the hazard of erosion is none to slight. The available water capacity is moderate. Permeability of the subsoil is moderate to very slow. The water table ranges from deep to shallow, and overflow is frequent.

These soils are used for pasture or hay. They are not suitable for cultivation. These soils can be reseeded to improved grasses or fertilized to increase production.

CAPABILITY UNIT VIe-HA, NONIRRIGATED

This capability unit consists of well-drained soils in the Flygare, Lucky Star, Mult, Red Spur, and Scave series. These soils have slightly convex to slightly rolling slopes of 3 to 30 percent and are on flood plains, alluvial fans, and mountains.

The surface layer of these soils is silt loam or loam and is gravelly in places. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Permeability of the subsoil is moderate. Average annual precipitation is 25 to 30 inches.

These soils are used mainly for watershed, range, and wildlife habitat, but they are used to some extent as woodland and for harvesting of aspen trees. They are not suitable for cultivation.

CAPABILITY UNIT VIe-HC, NONIRRIGATED

This capability unit consists of well-drained soils in the Cluff, Elwood, and Scout series. These soils have slopes that range from 6 to 40 percent, and they are on mountains.

The surface layer ranges from silt loam to very fine sandy loam or gravelly loam. Runoff is slow to rapid, and the hazard of erosion is slight to high. The available water capacity is moderate. Permeability of the subsoil is moderate to moderately rapid. Average annual precipitation is 25 to 35 inches.

These soils are used mainly for watershed, wildlife habitat, and range. Some areas have been used for harvesting Douglas-fir and other trees. These soils are unsuitable for cultivation.

The vegetation is mainly alpine fir, Douglas-fir, and aspen.

CAPABILITY UNIT VIe-M, NONIRRIGATED

This capability unit consists of well-drained soils in the Ant Flat, Despain, Goring, Hoskin, and Smarts series. These soils have slightly concave slopes of 6 to 30 percent and are on mountains and lake terraces.

The surface layer of these soils ranges from silty clay loam to gravelly loam. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderately high to high. Permeability of the subsoil is moderate to slow. Average annual precipitation is 18 to 25 inches.

Nearly all of the acreage is used for range, wildlife habitat, and watershed. Where the plant cover is in poor condition, the soils can be reseeded to grasses and legumes. Intermediate wheatgrass and alfalfa generally are used in seeding. These soils are unsuitable for cultivation.

CAPABILITY UNIT VIe-M5, NONIRRIGATED

This capability unit consists of well-drained soils in the Ant Flat, Goring, and Obray Series. These soils have slightly concave slopes of 1 to 30 percent and are on mountains, broad alluvial fans, and ridges.

The surface layer of these soils is silty clay loam or silty clay. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is high. Permeability of the subsoil is slow to very slow. Average annual precipitation is 18 to 25 inches.

These soils are used for range, watershed, and wildlife habitat. In most areas the vegetation has been depleted. Where the vegetation is in poor condition, the soils should be reseeded to grasses. Intermediate wheatgrass and some alfalfa generally are used in seeding. These soils are unsuitable for cultivation.

CAPABILITY UNIT VIe-MN, NONIRRIGATED

This capability unit consists of well-drained soils in the Clegg and LaPlatta series. These soils have slopes of 6 to 30 percent and are on mountains and alluvial fans. The climate severely restricts crop growth and the kind of crops that can be grown.

The surface layer of these soils is loam, silt loam, or silty clay loam, and it has a moderately high organic-matter content. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderately high. Permeability of the subsoil ranges from slow to moderate. Average annual precipitation is 18 to 26 inches.

These soils are used mainly for range, watershed, and wildlife habitat. They are not suitable for cultivation.

Where the plant cover is in poor condition, the soils can be reseeded to grasses and legumes. Intermediate wheatgrass and alfalfa generally are used in seeding. The Clegg soil requires clearing before it can be seeded.

CAPABILITY UNIT VIe-MX5, NONIRRIGATED

Hiibner gravelly clay loam, 20 to 30 percent slopes, is the only soil in this capability unit. This soil is well drained and is on foot slopes of mountains and high lake terraces.

Some areas of this soil are stony. Runoff is medium, and the hazard of erosion is moderate. The available water capacity is moderate. Permeability of the subsoil is slow. Average annual precipitation is 18 to 20 inches.

This soil is used for range, watershed, and wildlife habitat. Where the vegetation is in poor condition, the soil should be reseeded to grasses and legumes. Intermediate wheatgrass and alfalfa are suitable for reseeding. This soil is not suitable for cultivation.

CAPABILITY UNIT VIe-U, NONIRRIGATED

This capability unit consists of well-drained soils in the Collinston, Hillfield, Mendon, and Timpanogos series. These soils have slopes of 6 to 30 percent and are on terrace escarpments and fans.

The surface layer of these soils is loam. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderate. Permeability of the subsoil is moderate. Average annual precipitation is 15 to 20 inches.

These soils are used mostly for range. They are better suited to range or reseeding to grass or grass and legumes than to other uses.

CAPABILITY UNIT VIe-U1, NONIRRIGATED

This capability unit consists of well-drained soils in the Collinston and Wheelon series. These soils have slightly convex, rolling slopes of 10 to 30 percent.

The surface layer of these soils is silt loam to loam. Runoff is medium to rapid, and the hazard of erosion is moderate to high. The available water capacity is moderate. Permeability of the subsoil is moderate. Average annual precipitation is about 17 inches.

All of the acreage is used for range, wildlife habitat, and watershed. Where the plant cover is in poor condition, the soils should be reseeded to grasses and legumes. Intermediate wheatgrass and alfalfa generally are used in seeding.

CAPABILITY UNIT VIs-U4, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained soils in the Green Canyon, Lakewin, Ricks, Steed, and Sterling series. These soils are on narrow lake-terrace escarpments and fans. They have slopes that range from 0 to 20 percent.

The surface layer of these soils is gravelly loam. Runoff is slow to medium, and the erosion hazard is slight to moderate. The available water capacity is moderately low. Permeability of the subsoil is moderately rapid to rapid. Average annual precipitation is about 16 inches.

Most of the acreage is used for range and watershed. Some areas have been used for dryfarmed wheat and alfalfa, but crop growth is very poor. In areas that have been cultivated or where the native plant cover is in poor condition, the soils should be reseeded to grass. Crested wheatgrass generally is used for reseeding.

CAPABILITY UNIT VIIe-HA, NONIRRIGATED

This capability unit consists of well-drained soils in the Lucky Star, Mult, and Scave series. These soils generally have slopes of 30 to 70 percent and are on mountains. The Lucky Star soils are very cobbly. Scave extremely rocky silt loam, 10 to 30 percent slopes, is included in this capability unit because of its small acreage.

The surface layer generally is silt loam or gravelly silt loam. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderate to high. Permeability of the subsoil is moderate. Average annual precipitation is 25 to 35 inches.

These soils are used mainly for watershed, range, wildlife habitat, and woodland.

CAPABILITY UNIT VIIe-HC, NONIRRIGATED

This capability unit consists of well-drained soils in the Bickmore, Dateman, Elwood, and Scout series. These soils have slopes of 30 to 80 percent and are on mountains.

The surface layer is silt loam to gravelly, cobbly, or stony silt loam or loam. Some areas of Dateman soils are extremely rocky. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderate. Permeability of the subsoil is moderate to moderately rapid. Average annual precipitation is 25 to 30 inches.

These soils are used for watershed, woodland, wildlife habitat, and range. Douglas-fir has been harvested in some areas.

CAPABILITY UNIT VIIe-M, NONIRRIGATED

This capability unit consists of well-drained soils in the Despain, Goring, Nebeker, and Picayune series. These soils have slopes of 30 to 70 percent and are on mountains.

The surface layer of these soils is silt loam or gravelly loam. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderately high to high. Permeability of the subsoil ranges from moderate to slow. Average annual precipitation is 20 to 24 inches.

These soils are used for range, wildlife habitat, and watershed.

CAPABILITY UNIT VIIe-M4, NONIRRIGATED

This capability unit consists of well-drained soils that are on mountains and have slopes of 30 to 80 percent. These soils are in Bradshaw, Datwyler, Hoskin, Picayune, Poleline, Sheep Creek, and St. Marys series.

The surface layer ranges from gravelly loam, loam, or cobbly loam to cobbly silty clay loam. The content of organic matter in the surface layer is moderate to moderately high. Permeability of the subsoil is moderate to moderately low. Available water capacity is moderate to moderately low. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Average annual precipitation is 16 to 25 inches.

These soils are used mainly for range, wildlife habitat, and watershed.

CAPABILITY UNIT VIIe-MN, NONIRRIGATED

This capability unit consists of well-drained soils in the Barfuss, Elzinga, LaPlatta, Maughan, and Smarts series. These soils have mainly north-facing slopes of 30 to 70 percent and are on mountains.

The surface layer ranges from silt loam or gravelly silt loam to silty clay loam or gravelly loam. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderately high to high. Permeability of the subsoil is slow to moderately rapid. Average annual precipitation is 20 to 30 inches.

These soils are used for watershed, range, and wildlife habitat.

CAPABILITY UNIT VIIe-U, NONIRRIGATED

This capability unit consists of well-drained soils in the Leatham series and Rough broken land. These steep to very steep soils (slopes of 30 to 60 percent) are on foothills and mountains.

The surface layer is loam or silt loam. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is moderately high to high. Permeability of the subsoil is moderate. Average annual precipitation is about 18 inches.

These soils are used for watershed, range, and wildlife habitat.

CAPABILITY UNIT VIIe-U1, NONIRRIGATED

Wheelon silt loam, 30 to 50 percent slopes, eroded, is the only soil in this capability unit. This well-drained soil has steep, slightly convex, rolling slopes.

The surface layer generally is silt loam, but in small areas it is loam. Runoff is rapid, and the hazard of erosion is high. The available water capacity is moderate. Permeability of the subsoil is moderate. Average annual precipitation is about 17 inches.

All of the acreage is used for range, wildlife habitat, and watershed. Where the plant cover is in poor condition, the soil should be reseeded to grasses and legumes.

CAPABILITY UNIT VIIw-285, NONIRRIGATED

This capability unit consists of somewhat poorly drained soils that are affected by salt and alkali. These soils are in the Jordon, Lasil, and Payson series. They have slopes of 0 to 1 percent and are on low lake terraces.

The surface layer is silt loam or silty clay loam. The effect of salt and alkali is strong or very strong. Runoff is slow, and the hazard of erosion is none to slight. The available water capacity is moderately high. Permeability of the subsoil is slow or very slow. The depth to the water table is 30 to 48 inches.

These soils are used mainly for range. Some areas have been cultivated, although the soils are poorly suited to crops.

CAPABILITY UNIT VIIs-HXC, NONIRRIGATED

Fitzgerald extremely stony loam, 10 to 20 percent slopes, is the only soil in this capability unit. This well-drained soil is on mountains and in valleys.

Runoff is slow on this soil, and the hazard of erosion is slight. The available water capacity is moderate. Permeability is moderate. Average annual precipitation is 25 to 35 inches.

This soil is used mainly for watershed, woodland, wildlife habitat, and range.

CAPABILITY UNIT VIIs-MX3, NONIRRIGATED

This capability unit consists of somewhat excessively drained soils in the Agassiz, Curtis Creek, and Foxol series. These soils have slopes of 6 to 70 percent and are on mountains.

The surface layer is cobbly to extremely stony or rocky loam or silt loam. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. The available water capacity is low. Permeability is moderate to moderately rapid. Average annual precipitation is 18 to 27 inches.

These soils are used for range, watershed, and wildlife habitat.

CAPABILITY UNIT VIIs-MX4, NONIRRIGATED

This capability unit consists of well-drained soils in the Yeates Hollow series. These soils have slopes of 6 to 70 percent and are on alluvial fans and mountains.

The surface layer is extremely stony silty clay loam or silt loam. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. The available water capacity is moderate. Permeability of the subsoil is slow. Average annual precipitation is 20 to 25 inches.

These soils are used for range, water supply, and wildlife habitat.

CAPABILITY UNIT VIIs-MX5, NONIRRIGATED

This capability unit consists of well-drained soils in the Hiibner and Yeates Hollow series. These soils have slopes of 1 to 30 percent and are on alluvial fans and mountains.

The surface layer is extremely stony silty clay loam or silt loam. Runoff is slow to medium, and the hazard of erosion is slight to moderate. The available water capacity is moderate. Permeability of the subsoil is slow. Average annual precipitation is 20 to 24 inches.

These soils are used for range, water supply, and wildlife habitat.

CAPABILITY UNIT VIIs-UX3, NONIRRIGATED

This capability unit consists of somewhat excessively drained soils in the Richmond series. These soils have slopes of 30 to 70 percent and are on mountains.

The surface layer ranges from very stony loam to gravelly very fine sandy loam. Some areas are rocky. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. The available water capacity is very low. Permeability of the subsoil is moderately rapid. Average annual precipitation is 15 to 20 inches.

These soils are used mainly for range, watershed, and wildlife habitat.

CAPABILITY UNIT VIIs-U4, NONIRRIGATED

This capability unit consists of well-drained and somewhat excessively drained Blackrock, Middle, Munk, and Sterling soils and Stony alluvial land. These soils are mostly on long, narrow lake-terrace escarpments, foothills, and mountains. Slopes range mostly from 20 to 70 percent.

The surface layer of these soils is cobbly loam, gravelly loam, or extremely stony loam. Most areas have rock outcrops. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. The available water capacity is moderately low. Permeability of the subsoil is moderate to moderately rapid. Average annual precipitation is 15 to 20 inches.

These soils are used mainly for range, watershed, and wildlife habitat.

CAPABILITY UNIT VIIIw-28, NONIRRIGATED

Cache silty clay is the only soil in this capability unit. This is a poorly drained, fine-textured soil that is affected by salt. This nearly level soil is on valley bottoms. It is inundated by water at times during the year. This soil is bare, except for scattered patches of saltgrass and pickleweed. It is of little or no value for farming.

CAPABILITY UNIT VIIIw-4, NONIRRIGATED

This capability unit consists of very gravelly and cobbly areas of Riverwash along or adjacent to permanent streams. This land type has low available water capacity, and frequent overflow very severely restricts its use. It is generally not suitable for cropping, and lack of a cover of plants prohibits its use for range.

CAPABILITY UNIT VIIIs-4, NONIRRIGATED

Gravel pit is the only mapping unit in this capability unit. This land type consists of very gravelly and cobbly soil material in gravel pits. This material is used mostly as a source of gravel and sand for concrete or other construction. It has little or no vegetation growing on it, and it is of no value for farming.

CAPABILITY UNIT VIIIs-X, NONIRRIGATED

This capability unit consists of Rock land and rock outcrops. The acreage is large, but individual areas are comparatively small and are dispersed throughout the mountains and foothills. The areas have little or no vegetation. They are not suitable for farm use, but are suitable for wildlife shelter. The adjacent soils provide food and cover for wildlife.

Estimated Yields

Table 2 gives the estimated average acre yields of the principal crops and pasture grown on cultivated soils in the survey area. Yields are given for the main crops grown under irrigation and for nonirrigated alfalfa, wheat, and barley. These yields are estimated on the basis of information obtained from farmers, district conservationists of the Soil Conservation Service, the county agricultural extension agent, the local office of the Agricultural Stabilization and Conservation Service, and census reports. If no information was available for a particular soil, the estimates were made on the basis of yields on a similar soil. The estimates are given for one level of management, which is defined in the following paragraphs.

To obtain the yields for irrigated crops listed in table 2, the following management practices should be used: The soils are leveled and adequately drained. Structures for efficient use of irrigation water are adequate. The method of irrigation, size of streams, and length of irrigation runs are adjusted to the estimated intake rate of

TABLE 2.—*Estimated average acre yields of principal crops*

[Absence of yield indicates crop is not generally grown or is not suited to the soil. Range and woodland soils and miscellaneous land types that are not listed are normally not suitable for the crops named. Yields from wet soils and from soils affected by salt and alkali are obtained after adequate drainage and reclamation practices have been applied]

Mapping units	Irrigated crops						Nonirrigated crops		
	Alfalfa	Wheat	Barley	Sugar beets	Corn for silage	Pasture	Alfalfa	Wheat	Barley
	Tons	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Tons*	*Bu.*	*Bu.*
Airport silt loam, 0 to 3 percent slopes	3. 5	30	55	15	18	200	1. 5	----	40
Airport silty clay loam	3. 0	30	50	15	16	200	1. 5	----	40
Avon silty clay loam, 0 to 3 percent slopes	6. 0	65	80	----	----	275	2. 5	40	45
Avon silty clay loam, 3 to 6 percent slopes	5. 0	65	80	----	----	275	2. 5	40	45
Avon silty clay loam, 6 to 10 percent slopes	----	----	----	----	----	----	2. 0	35	----
Avon silty clay loam, 10 to 20 percent slopes	4. 0	50	----	----	----	----	2. 0	30	----
Battle Creek silty clay loam, 0 to 2 percent slopes	6. 0	75	85	21	20	275	2. 0	40	35
Battle Creek silty clay loam, 8 to 15 percent slopes	----	----	----	----	----	250	2. 0	35	30
Blackrock gravelly loam, 3 to 6 percent slopes	----	----	----	----	----	----	2. 0	35	35
Blackrock gravelly loam, 6 to 10 percent slopes	----	----	----	----	----	----	1. 7	30	35
Blackrock gravelly loam, 10 to 20 percent slopes	----	----	----	----	----	----	1. 5	25	----
Cardon silty clay	4. 5	65	75	15	18	275	----	----	----
Collett silty clay loam	5. 0	65	75	20	20	275	----	----	----
Collinston loam, 1 to 6 percent slopes	----	----	----	----	----	----	1. 5	20	20
Collinston loam, 6 to 10 percent slopes	----	----	----	----	----	----	1. 5	20	20
Collinston loamy fine sand, 0 to 3 percent slopes	----	----	----	----	----	----	1. 5	22	22
Crookston loam, 0 to 3 percent slopes	6. 0	65	80	18	20	275	2. 5	40	45
Crookston loam, 3 to 6 percent slopes	5. 0	65	80	----	----	275	2. 5	35	40
Crookston loam, 6 to 10 percent slopes	4. 5	60	----	----	----	----	2. 0	35	35
Crowshaw gravelly loam, 3 to 6 percent slopes	----	----	----	----	----	----	2. 0	40	45
Crowshaw gravelly loam, 6 to 10 percent slopes	----	----	----	----	----	----	2. 0	40	45
Crowshaw gravelly loam, 10 to 20 percent slopes	----	----	----	----	----	----	2. 0	25	40
Dagor silt loam, 4 to 8 percent slopes	----	----	----	----	----	----	2. 0	40	45
Dagor silt loam, 10 to 20 percent slopes	----	----	----	----	----	----	2. 0	15	40
Green Canyon gravelly loam, 0 to 3 percent slopes	4. 0	55	50	----	----	250	----	----	----
Green Canyon gravelly loam, 3 to 7 percent slopes	3. 5	50	45	----	----	250	----	----	----
Greenson loam, 0 to 3 percent slopes	5. 0	75	90	21	24	300	----	----	----
Greenson loam, 3 to 6 percent slopes	4. 5	60	75	----	----	275	----	----	----
Greenson loam, 6 to 10 percent slopes	3. 5	60	70	----	----	275	----	----	----
Greenson loam, deep over gravel, 0 to 1 percent slopes	4. 5	75	85	20	22	275	----	----	----
Greenson loam, deep over clay, 0 to 1 percent slopes	5. 0	75	90	20	22	275	----	----	----
Hendricks silt loam, 1 to 3 percent slopes	6. 0	75	85	22	22	300	2. 0	40	35
Hendricks silt loam, 3 to 6 percent slopes	5. 5	70	80	----	----	300	2. 0	40	35
Hendricks silt loam, 6 to 10 percent slopes	5. 0	55	75	----	----	250	2. 0	35	30
Hendricks silt loam, 10 to 20 percent slopes	----	----	----	----	----	----	1. 7	35	30
Hiibner gravelly clay loam, 3 to 10 percent slopes	----	----	----	----	----	----	1. 5	25	----
Hyrum gravelly loam, 4 to 8 percent slopes	----	----	----	----	----	----	2. 0	35	30
Hyrum gravelly loam, 10 to 25 percent slopes	----	----	----	----	----	----	1. 5	30	25
Hyrum cobbly loam, 4 to 8 percent slopes	----	----	----	----	----	----	1. 8	30	30
Kidman fine sandy loam, 0 to 2 percent slopes	6. 0	80	90	22	20	330	----	----	----
Kidman fine sandy loam, 8 to 15 percent slopes	5. 0	60	75	----	----	225	----	----	----
Kidman fine sandy loam, deep water table, 0 to 2 percent slopes	6. 0	80	90	22	20	300	----	----	----
Kidman fine sandy loam, deep water table, 2 to 4 percent slopes	5. 5	80	90	22	20	300	----	----	----
Kidman fine sandy loam, deep water table, 4 to 8 percent slopes	5. 0	70	75	----	----	250	----	----	----
Kirkham-Shay complex	4. 5	60	70	20	18	275	----	----	----
Layton loamy fine sand	5. 5	70	90	22	20	300	----	----	----
Lewiston fine sandy loam	5. 0	75	85	20	20	275	----	----	----
Lewiston fine sandy loam, strongly alkali	4. 0	60	75	----	----	250	----	----	----
Logan silty clay loam	4. 0	65	75	18	20	----	----	----	----
McMurdie silt loam, 0 to 3 percent slopes	6. 0	75	85	22	22	----	2. 0	45	35
McMurdie silt loam, 3 to 6 percent slopes	5. 5	70	80	----	----	----	2. 0	40	35
McMurdie silt loam, 6 to 10 percent slopes	5. 0	55	75	----	----	----	2. 0	35	30
Mendon silt loam, 0 to 3 percent slopes	6. 0	65	80	18	----	----	2. 5	40	45
Mendon silt loam, 3 to 6 percent slopes	5. 0	65	80	----	----	----	2. 5	40	45
Mendon silt loam, 6 to 10 percent slopes	4. 5	60	----	----	----	----	2. 0	35	----
Millville silt loam, 0 to 2 percent slopes	5. 0	75	90	21	24	----	----	----	----

See footnote at end of table.

TABLE 2.—*Estimated average acre yields of principal crops*—Continued

Mapping units	Irrigated crops						Nonirrigated crops		
	Alfalfa	Wheat	Barley	Sugar beets	Corn for silage	Pasture	Alfalfa	Wheat	Barley
	Tons	*Bu.*	*Bu.*	*Tons*	*Tons*	*Cow-acre-days* [1]	*Tons*	*Bu.*	*Bu.*
Millville silt loam, 2 to 4 percent slopes	6. 0	85	90	22	25	--------	--------	--------	--------
Nebeker silt loam, 3 to 6 percent slopes	5. 5	70	80	--------	--------	--------	2. 0	40	35
Nebeker silt loam, 6 to 10 percent slopes	5. 0	55	75	--------	--------	--------	2. 0	35	30
Nebeker silt loam, 10 to 25 percent slopes	--------	--------	--------	--------	--------	--------	1. 8	35	30
Nibley silty clay loam, 0 to 3 percent slopes	5. 0	65	75	20	20	275	--------	--------	--------
Nibley silty clay loam, 3 to 6 percent slopes	4. 5	60	60	20	--------	275	--------	--------	--------
Parleys silt loam, 0 to 3 percent slopes	6. 0	85	90	22	25	300	2. 0	35	35
Parleys silt loam, 3 to 6 percent slopes	5. 0	75	80	20	--------	275	2. 0	30	30
Parleys silt loam, 6 to 10 percent slopes	5. 0	60	75	--------	--------	200	1. 8	25	--------
Parlo silt loam, 0 to 3 percent slopes	6. 0	85	90	22	25	350	1. 5	30	--------
Parlo silt loam, 3 to 6 percent slopes	5. 0	75	--------	--------	--------	--------	1. 5	30	--------
Parlo silt loam, 6 to 10 percent slopes	--------	--------	--------	--------	--------	--------	1. 5	30	--------
Preston fine sand, 0 to 10 percent slopes	3. 0	50	70	--------	--------	200	--------	--------	--------
Provo loam	4. 0	60	70	--------	18	200	--------	--------	--------
Quinney silt loam	4. 5	35	60	16	18	220	--------	--------	--------
Ricks gravelly loam, 0 to 3 percent slopes	4. 5	55	50	--------	--------	250	--------	--------	--------
Ricks gravelly loam, 3 to 6 percent slopes	4. 0	55	50	--------	--------	250	--------	--------	--------
Ricks gravelly loam, 6 to 10 percent slopes	4. 0	--------	--------	--------	--------	225	--------	--------	--------
Roshe Springs silt loam	5. 0	75	90	21	26	300	--------	--------	--------
Salt Lake silty clay loam	4. 5	65	75	15	18	275	--------	--------	--------
Shay silty clay loam	4. 5	60	60	18	19	275	--------	--------	--------
Steed gravelly loam, 0 to 3 percent slopes	3. 5	45	70	--------	--------	225	--------	--------	--------
Steed gravelly loam, 3 to 6 percent slopes	3. 0	40	40	--------	--------	225	--------	--------	--------
Steed gravelly loam, 6 to 10 percent slopes	3. 0	--------	--------	--------	--------	200	--------	--------	--------
Sterling gravelly loam, 6 to 10 percent slopes	3. 0	40	50	--------	--------	225	--------	--------	--------
Sterling gravelly loam, 10 to 20 percent slopes	3. 0	40	45	--------	--------	225	--------	--------	--------
Timpanogos silt loam, 0 to 3 percent slopes	6. 0	85	90	22	25	300	2. 0	35	35
Timpanogos silt loam, 3 to 6 percent slopes	5. 5	75	80	20	--------	275	2. 0	30	35
Timpanogos silt loam, 6 to 10 percent slopes	5. 0	60	75	--------	--------	200	1. 5	25	--------
Timpanogos silt loam, 10 to 20 percent slopes, eroded	--------	--------	--------	--------	--------	--------	1. 5	25	--------
Timpanogos silt loam, deep water table, 0 to 3 percent slopes	5. 0	80	90	22	24	300	--------	--------	--------
Trenton silty clay loam, 0 to 2 percent slopes	5. 0	35	60	16	20	250	1. 0	27	24
Trenton silty clay loam, 2 to 4 percent slopes	5. 0	35	60	--------	20	250	1. 0	27	24
Trenton silty clay loam, 4 to 8 percent slopes	4. 5	35	60	--------	--------	220	1. 0	27	24
Trenton silty clay loam, 8 to 20 percent slopes, eroded	--------	--------	--------	--------	--------	--------	. 8	25	22
Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes	3. 5	30	55	15	18	250	--------	--------	--------
Winn silt loam	4. 0	55	70	16	16	250	--------	--------	--------
Woods Cross silty clay loam	4. 5	70	75	--------	--------	250	--------	--------	--------

[1] Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units carried per acre multiplied by the number of days the pasture is grazed during a single season without injury to the sod. An acre of pasture that provides 30 days of grazing for 2 cows has a carrying capacity of 60 cow-acre-days.

the soils, the available water capacity, the hazard of erosion, and the water needed to replace that lost since the last irrigation. In areas where salt and alkali occur, the soils are periodically leached.

Soils that have a texture of loam to clay are plowed in fall, and those with a texture of sandy loam to sand, in spring. They are harrowed and floated once. Borders and corrugations for cover crops are made, and the seeds are drilled.

Only a good quality of clean seeds, mostly certified, are used. Alfalfa is planted from March 15 to April 15, or, in stubble, from August 1 to September 1. Barley is planted from March 15 to April 30 or from September 1 to September 30. Sugar beets are planted from March 15 to April 15.

A suitable rotation to obtain the yields is alfalfa for 3 to 5 years, small grains for 1 to 2 years, row crops for 1 to 2 years, and small grains and alfalfa for 1 year. Alfalfa requires 100 to 120 pounds of phosphate fertilizer per acre when it is seeded and again in the third year. Small grains need 50 to 100 pounds of nitrogen fertilizer per acre or to 20 tons of barnyard manure. None is needed the first year if small grains are planted after alfalfa. Sugar beets need 80 to 100 pounds of nitrogen fertilizer or 15 to 20 tons of barnyard manure and 75 to 100 pounds of phosphate fertilizer.

Weeds are controlled by tilling, spraying, and hoeing. Dodder is removed from alfalfa. Measures to control diseases and insects are adequately applied when needed. Where sugar beets follow sugar beets, the soils are fumigated for nematodes.

Harvesting is done when the crop is at its peak of maturity to obtain highest yields and best quality.

To obtain the yields for nonirrigated crops listed in table 2, the soils are stabilized and erosion is controlled by using such practices as stubble mulching, contour tillage, grassed waterways, and proper disposal of water.

The soils are tilled in spring by noble blade or wheatland plow and by rod weeder twice during summer and once before seeding if weeds are a problem.

Certified cleaned seeds are used. Planting is done from September 1 to September 20 in most years at a rate of 40 to 60 pounds per acre.

Nitrogen fertilizer is applied early in spring at a rate of 20 to 40 pounds per acre in years when precipitation is above average.

Weeds are controlled by spraying as needed. Insects and diseases are controlled by spraying and tillage.

Seeding, tillage, and harvesting are done at the best time to obtain the highest yields.

Use of the Soils for Range[3]

Soils in the Cache Area that are used for range generally are not suited to cultivation, because of soil characteristics, site factors, or climatic limitations. Some of the soils are very gravelly or very cobbly or stony, and the areas are interspersed with areas of rock outcrop. Many of the soils are very steep; some soils are wet or are affected by salts or alkali, and these limitations cannot economically be corrected; and some soils are at high elevations where the climate is too cold or the growing season is too short for cultivated crops. Soils used for range are shallow to very deep and have textures ranging from sand to clay. Some soils are uniform throughout their depth; others have been excessively leached and have formed distinct horizons.

Range is an important resource in the Cache Area. Approximately 310,000 acres, or 60 percent of the survey area, is in native vegetation and is used for range. Perennial grasses, shrubs, and forbs are the main kinds of vegetation, but some areas are under a cover of aspen, maple, and coniferous trees. Woodland areas are used to some extent as range. The acreage of conifers and aspen trees amounts to about 15 percent of the total acreage in the survey area, or about 80,000 acres. Maple is the dominant cover on about 3 percent of the survey area, or about 15,000 acres. The total acreage in range includes about 30,000 acres of wet meadow pastures. These pastures are used principally for range, but some of the grasses are cut for meadow hay.

Range is used primarily for grazing by sheep and cattle in spring, summer, and fall. The soils on the Wellsville Mountains within the Cache National Forest are withheld from grazing and are used only as watershed.

Range Sites and Condition Classes

All of the soils of the survey area that are still in native vegetation and that are used for range have been grouped into range sites. Range sites are distinctive kinds of rangeland with different potentials for producing native plants. Each range site has its own combination of environmental conditions. Distinction between range sites is recognized by differences in kinds and proportions of native plants that compose the potential plant community.

Range condition is the present state of the vegetation in relation to the potential condition for that site. Four condition classes are recognized. Range in *excellent* condition has 76 to 100 percent of the vegetation that is characteristic of the potential vegetation for the same site; that in *good* condition, 51 to 75 percent; that in *fair* condition, 26 to 50 percent; and that in *poor* condition, less than 26 percent. Range condition is determined by comparing present vegetation with the potential.

Plants are grouped according to their response to grazing. *Decreaser* plants are species present in the potential plant community that decrease in relative abundance with continued moderately heavy or heavy grazing use. They are mainly perennials that are palatable to livestock and are generally, although not always, dominant species of the potential plant community.

Increaser plants are species present in the potential plant community that normally increase in abundance as the decreaser plants decline. Some plants that increase at first may later decrease as intensive use is continued. Increaser plants are commonly, although not always, the shorter, less productive members of the potential vegetation. Their forage value ranges from high to low.

Invaders are plants that are not members of the potential plant community for the site. These plants invade, occupy the site, and increase in amount when the decreaser plants are too heavily grazed. The invader plants are not restricted to exotics. They may be normal components of the potential plant community on other range sites in the same locality.

Climatic Zones and Their Effect on Range

Plants growing on the range in different parts of the survey area are affected not only by differences in the kinds of soil but also by differences in climate. Four climatic zones are recognized in the survey area. These zones are determined on the basis of differences in the amount of moisture received, on differences in the average annual temperature, and on the length of the growing season. Zones are the Upland climatic zone; the Mountain climatic zone; the High Mountain climatic zone; and the Wet and Semiwet climatic zone.

UPLAND CLIMATIC ZONE. In this zone the annual precipitation ranges from 14 to 17 inches and falls mostly as snow. Precipitation in summer contributes little to the growth of plants. The period when plants make their greatest amount of growth begins about April 1 and continues until moisture is depleted or until the plants mature, generally about July 1. Some plants show growth late in summer and early in fall if moisture is available. The frost-free season is about 150 days. The mean annual air temperature is 45° to 50° F.

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[3] BENJAMIN B. HEYWOOD, range conservationist, Soil Conservation Service, assisted in the preparation of this section.

Three range sites are in the Upland climate zone. They are the Upland Shallow Loam, the Upland Stony Loam, and the Upland Loam.

MOUNTAIN CLIMATIC ZONE. In this zone the average annual precipitation ranges from 17 to 25 inches and is mostly snow. Precipitation in summer contributes little to plant growth. The growing season is from about April 15 to about July 31 or until moisture is depleted or plants mature. If moisture is available, some plants grow until late in summer or early in fall. Mountain range sites are on all exposures and slopes. The elevations range from 5,000 to 8,000 feet. The mean annual air temperature is 36° to 45° F.

In the Cache Area, six range sites are in the Mountain climatic zone. These are the Mountain Shallow Loam, the Mountain Stony Loam, the Mountain Clay, the Mountain Stony Clay, the Mountain Loam (Shrubs), and the Mountain Loam.

HIGH MOUNTAIN CLIMATIC ZONE. The average annual precipitation ranges from 25 to 35 inches and is mostly as snow. The growing season is from about May 15 to about September 20 or until a killing frost in fall. High Mountain sites are on all exposures and slopes. The elevations range from 7,000 to 9,500 feet. The mean annual air temperature ranges from 35° to 42° F.

Two range sites are in the High Mountain climatic zone. These are the High Mountain Loam (Aspen) and High Mountain Loam (Conifer). They are mostly covered by trees, but some forage is available for grazing.

WET AND SEMIWET ZONE. In this zone the soils are wet because they receive run-in water or have a high water table. In these areas, the climate is characterized by cold, snowy winters and warm, dry summers. The average annual precipitation ranges from 14 to 17 inches. Most of the water available to plants is from run-in water from adjacent irrigated land or from the water table. The growing season is from about April 15 to about September 1 or until frost. The frost-free season is 120 to 130 days. The mean annual air temperature is about 45° F.

Range sites in the Wet and Semiwet zone are Wet Meadow, Semiwet Meadow, and Alkali Bottom.

Descriptions of Range Sites

Fourteen range sites have been recognized in the survey area. These are described in the following pages.

ALKALI BOTTOM RANGE SITE

This site consists of somewhat poorly drained and moderately well drained soils on low lake terraces and on flood plains. Slopes range from 0 to 20 percent. These soils are moderately to strongly affected by salt and alkali. The surface layer is mainly silt loam, but in places it is loam or silty clay loam. Permeability is slow to very slow. Available water capacity to a depth of 5 feet is moderately high. Runoff is slight to ponded, and the hazard of erosion is slight. The depth to the water table is most commonly between 20 and 40 inches. Plants commonly are shallow rooted because of the high concentration of salt and alkali in the subsoil and substratum.

The potential plant community consists of salt- and alkali-tolerant perennial grasses, which are 50 to 60 percent decreaser grasses and 30 to 40 percent increaser grasses; 0 to 1 percent forbs; and 5 to 10 percent shrubs. Common invaders on this site are cheatgrass, povertyweed, snakeweed, big sagebrush, saltcedar, and curlycup gumweed. Plant density is 45 to 50 percent.

Early grazing and heavy grazing have caused saltgrass, foxtail, and other increasers to become prominent on this range site. Fencing into smaller pastures and rotated deferred systems of grazing will improve the vegetation on this site.

The approximate composition of the climax (or potential) plant community for the Alkali Bottom range site is:

Species	*Percentage by weight*
Alkali bluegrass	10
Alkali cordgrass	5
Alkali sacaton	10
Creeping wildrye	2
Great Basin wildrye	5
Tufted hairgrass	5
Other grasses and grasslike plants[1]	5
Saltgrass	25
Sedges	10
Wiregrass	3
Total forbs	1
Big rabbitbrush[1]	2
Fourwing saltbush	5
Nuttall saltbush	5
Gray molly	2
Greasewood[1]	5
Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,700 to 2,500 pounds of air-dry forage per acre in favorable years and 650 to 1,000 pounds per acre in less favorable years. Approximately 90 percent of this production is from plants that provide forage for livestock and wildlife.

HIGH MOUNTAIN LOAM (ASPEN) RANGE SITE

This site consists of well-drained soils on mountains, fans, and valley bottoms. Slopes are 3 to 70 percent. In most places these soils are gravelly, cobbly, and stony on the surface or in the profile. They are moderately permeable. The available water capacity is moderate to high, and roots penetrate to a depth of 5 feet or more. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. This site is on all exposures. On north- and east-facing slopes, the site is at lower elevations than it is on the south- and west-facing slopes.

The potential plant community is aspen and an understory of 30 to 40 percent decreaser grasses and 10 to 20 percent increaser grasses, 40 to 50 percent forbs, and 5 to 15 percent shrubs. Common invaders are annuals, stinging nettle, tarweed, and big sagebrush. Density of the aspen overstory is 50 to 70 percent.

Range deterioration is shown by the reduction of the better grasses and the increase in western coneflower, shrubs, such as snowberry, and other less palatable plants. Broadcast seeding of orchardgrass or other grasses is possible in some areas. The proper time for these seedings is early in fall. Range improvement is mostly dependent on proper range use and on a rotation-deferred system of grazing.

The woodland value of this site is discussed further in the section "Use of the Soils as Woodland" in this soil survey. The wood products from this site are most useful for excelsior core stock.

The approximate composition of the potential plant community for the High Mountain Loam (Aspen) range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bearded wheatgrass	5	Peavine	4
Blue wildrye	10	Sweet anise	3
Dryland sedge	2	Tall larkspur	1
Mountain brome	20	Western coneflower [1]	1
Nodding bluegrass	3	Other forbs	6
Other grasses	3	Aspen [1]	30
Butterweed	4	Shrubs	3
Cowcabbage	1		
Edible valerian	4	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 4,500 to 5,300 pounds of air-dry forage per acre in favorable years and 1,800 to 3,200 pounds per acre in less favorable years. Approximately 70 percent of this production is from plants that provide forage for livestock and wildlife.

HIGH MOUNTAIN LOAM (CONIFER) RANGE SITE

This site consists of well-drained and somewhat excessively drained soils on mountains. It is mainly on north- and east-facing slopes at lower elevations, but is on south- and west-facing slopes at higher elevations. Slopes are 6 to 70 percent. In most places these soils are gravelly, cobbly, or stony on the surface and in the profile. The permeability is moderate to moderately rapid. The available water capacity is moderate to high. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

The potential plant community is dominantly mixed stands of alpine fir, Douglas-fir, Engelmann spruce, and aspen. Logging, fire, and disease have thinned the tree stands in some areas. Grass and shrubs provide a considerable amount of forage for livestock and wildlife.

The more important decreasers are blue wildrye, mountain brome, and bearded wheatgrass. The more important increasers are pinegrass and Kentucky bluegrass. A common invader is western coneflower.

The woodland value of this site is discussed further in the section "Use of the Soils as Woodland" in this soil survey.

MOUNTAIN CLAY RANGE SITE

This site consists of well-drained soils in the lower areas on fans and mountains and on small valley bottoms. Slopes range from 3 to 30 percent. Generally, these soils have a clay or silty clay texture within a depth of 12 inches. They are slowly permeable. The available water capacity is high. Runoff is slow to medium, and the erosion hazard is slight to moderate. In most areas, swelling and cracking has caused an irregular surface.

The potential plant community is 75 to 85 percent decreaser grasses, 5 to 10 percent increaser grasses, 5 percent forbs, and 5 percent shrubs. The dominant grasses are slender wheatgrass and Idaho fescue. Common invaders are cheatgrass, squirreltail, tarweed, gumweed, and big sagebrush. Plant density is 55 to 65 percent.

Because of its accessibility and the gentle slopes of the soils, this range site has been used heavily by livestock. Excessive and untimely grazing has caused mulesear dock and low sagebrush to increase and become the dominant plants. Many of the better grasses are lacking, or they make up only a small percentage of the present plant cover.

These soils are suitable for plowing and reseeding, but, because the soils are fine textured, timing of operations at the right moisture content is extremely important. This site responds exceptionally well to spraying for the control of broad-leaved plants, big sagebrush, and low sagebrush.

The approximate composition of the potential plant community for the Mountain Clay range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	5	Total forbs [1]	5
Columbia needlegrass	3	Bitterbrush	1
Great Basin wildrye	5	Big sagebrush [1]	1
Idaho fescue	10	Serviceberry	2
Slender wheatgrass	50	Other shrubs [1]	3
Western wheatgrass	5	Total	100
Other grasses	10		

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,800 to 3,500 pounds of air-dry forage per acre in favorable years and 1,500 to 1,750 pounds per acre in less favorable years. Approximately 90 percent of this production is from plants that provide forage for livestock and wildlife.

MOUNTAIN LOAM RANGE SITE

This site consists of well-drained soils on fans, mountains, and small valley bottoms. Slopes range from 6 to 80 percent. In places these soils have gravel and cobblestones in the lower part of the profile. They are moderately to slowly permeable. The available water capacity is moderately high to high. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

The potential plant community is 75 to 85 percent decreaser grasses, 10 to 20 percent increaser grasses, 3 to 5 percent forbs, and 5 to 10 percent shrubs. Common invaders are cheatgrass, gumweed, and horsebrush.

Early grazing and overgrazing in the past caused an increase in big sagebrush and broadleaved forbs in many areas, and fires caused an increase in yellowbrush and big rabbitbrush. In recent years, however, large areas have been sprayed and the vegetation is in good or excellent condition. Spraying with 2, 4-D is effective in suppressing undesirable shrubs and forbs. Where slopes are 30 percent or less, the soils are suitable for plowing and reseeding.

The approximate composition of the potential plant community for the Mountain Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	61	Big sagebrush [1]	2
Great Basin wildrye	3	Snowberry	1
Other grasses	15	Yellowbrush [1]	1
Tall native bluegrass	6	Other shrubs	2
Total forbs	5	Total	100
Bitterbrush	4		

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,750 to 2,750 pounds of air-dry forage per acre in favorable years and 1,050 to 1,750 pounds per acre in less favorable years. Approximately 95 percent of this production is from plants that provide forage for livestock and wildlife.

MOUNTAIN LOAM (SHRUBS) RANGE SITE

This site consists of well-drained soils on east- and north-facing slopes of mountains and in small canyons and drainageways. Slopes range from 20 to 70 percent. In places these soils are gravelly and cobbly. They are moderately to slowly permeable. The available water capacity is moderately high to high. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high.

Generally, snowdrifts increase the available moisture. The increase in available moisture has caused such shrubs and trees as ceanothus, maple, and chokecherry to increase in density and give the site a woodland appearance.

The potential plant community consists of 40 to 55 percent decreaser grasses, 15 to 20 percent increaser grasses, 10 to 15 percent forbs, and 15 to 25 percent shrubs. The common invaders are gumweed, houndstongue, and big rabbitbrush. The plant density is 40 to 50 percent.

Heavy grazing and fire have caused an increase in maple and other browse plants. The dense cover of woody plants limits the grazing value of this site. This site is better suited to use by sheep than by cattle. The excellent food and cover on this site are very important to the deer herds.

The use of mechanical equipment in improving the site is not feasible, because of the steep and very steep, rough topography. It is possible to spray some areas with herbicides and retard the browse growth; however, range improvement depends mostly on proper range use and or rotation and deferred grazing.

The approximate composition of the potential plant community for the Mountain Loam (Shrubs) range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bearded wheatgrass	3	Other forbs[1]	9
Bluebunch wheatgrass	33	Big sagebrush[1]	2
Great Basin wildrye	8	Bitterbrush	2
Western wheatgrass	3	Maple[1]	20
Other grasses	10	Other shrubs	5
Balsamroot	2	Total	100
Little sunflower	3		

[1] These plants show little or no use by livestock.

This range site has an estimated total production of 2,400 to 3,000 pounds of air-dry forage per acre in favorable years and 1,500 to 2,000 pounds per acre in less favorable years. Approximately 70 percent of this production is from plants that provide forage for livestock and wildlife.

MOUNTAIN SHALLOW LOAM RANGE SITE

This site consists of somewhat excessively drained, stony and cobbly soils. These soils are most commonly on south- and west-facing slopes and on ridgetops. Slopes range from 6 to 70 percent. The permeability is moderately rapid to moderate. The available water capacity is low. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. Snow often blows off of this site. Effective moisture for plant growth is generally depleted by about July 1.

The potential plant community consists of 30 to 45 percent decreaser grasses, 5 to 20 percent increaser grasses, 3 to 15 percent forbs, and 40 to 50 percent shrubs. Common invaders are thistle, tarweed, mulesear dock, cheatgrass, yellowbrush, and juniper. Plant density is 30 to 35 percent.

This range site is used extensively by deer in winter and spring. Overuse in the past has caused an increase in curlleaf mountain-mahogany, serviceberry, and other undesirable shrubs and a decrease in the better grasses and desirable browse and forbs. Range improvement practices are restricted to proper range use and rotation-deferred grazing because of the rough, steep topography and shallow soils.

The approximate composition of the potential plant community for Mountain Shallow Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	20	Bitterbrush	15
Great Basin wildrye	10	Big sagebrush[1]	8
Indian ricegrass	2	Oakbrush[1]	3
Tall native bluegrass	3	Serviceberry	3
Other grasses	8	Yellowbrush[1]	3
Balsamroot	5	Other shrubs[1]	5
Other forbs[1]	10	Total	100
Birchleaf mountain-mahogany	5		

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,250 to 1,750 pounds of air-dry forage per acre in favorable years and 550 to 1,000 pounds per acre in less favorable years. Approximately 80 percent of this production is from plants that provide forage for livestock and wildlife.

MOUNTAIN STONY CLAY RANGE SITE

This site consists of well-drained soils (fig. 16) on fans and foot slopes of mountains. Slopes are 1 to 30 percent. Stones and cobblestones, ranging from 3 inches to 3 feet in diameter, are on the surface and throughout the profile. The available water capacity is moderate. The permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

The potential plant community is about 70 percent decreaser grasses, 10 percent increaser grasses, 10 percent forbs, and 10 percent shrubs. Common invaders are big sagebrush, big rabbitbrush, tarweed, gumweed, and cheatgrass. Plant density is 50 to 60 percent.

Early grazing and heavy grazing have caused an increase in low sagebrush and mulesear dock. Now these plants generally are dominant on the site.

Range seeding is not feasible, because of the stony, fine-textured soils. However, the vigor and density of desirable grasses can be improved by spraying the broad-leaved plants and low sagebrush. This site is well suited to aerial spraying, and results are excellent. Rotation-deferred grazing and proper range use are necessary on this site.

The approximate composition of the potential plant community for Mountain Stony Clay range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	15	Mulesear dock[1]	4
Great Basin wildrye	25	Other forbs	6
Slender wheatgrass	35	Bitterbrush	5
Tall native bluegrass	4	Other shrubs[1]	3
Other grasses	3	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 3,000 to 3,300 of air-dry forage per acre in favorable years and 1,000 to 1,700 pounds per acre in less favorable years. Approximately 95 percent of this production is from plants that provide forage for livestock and wildlife.

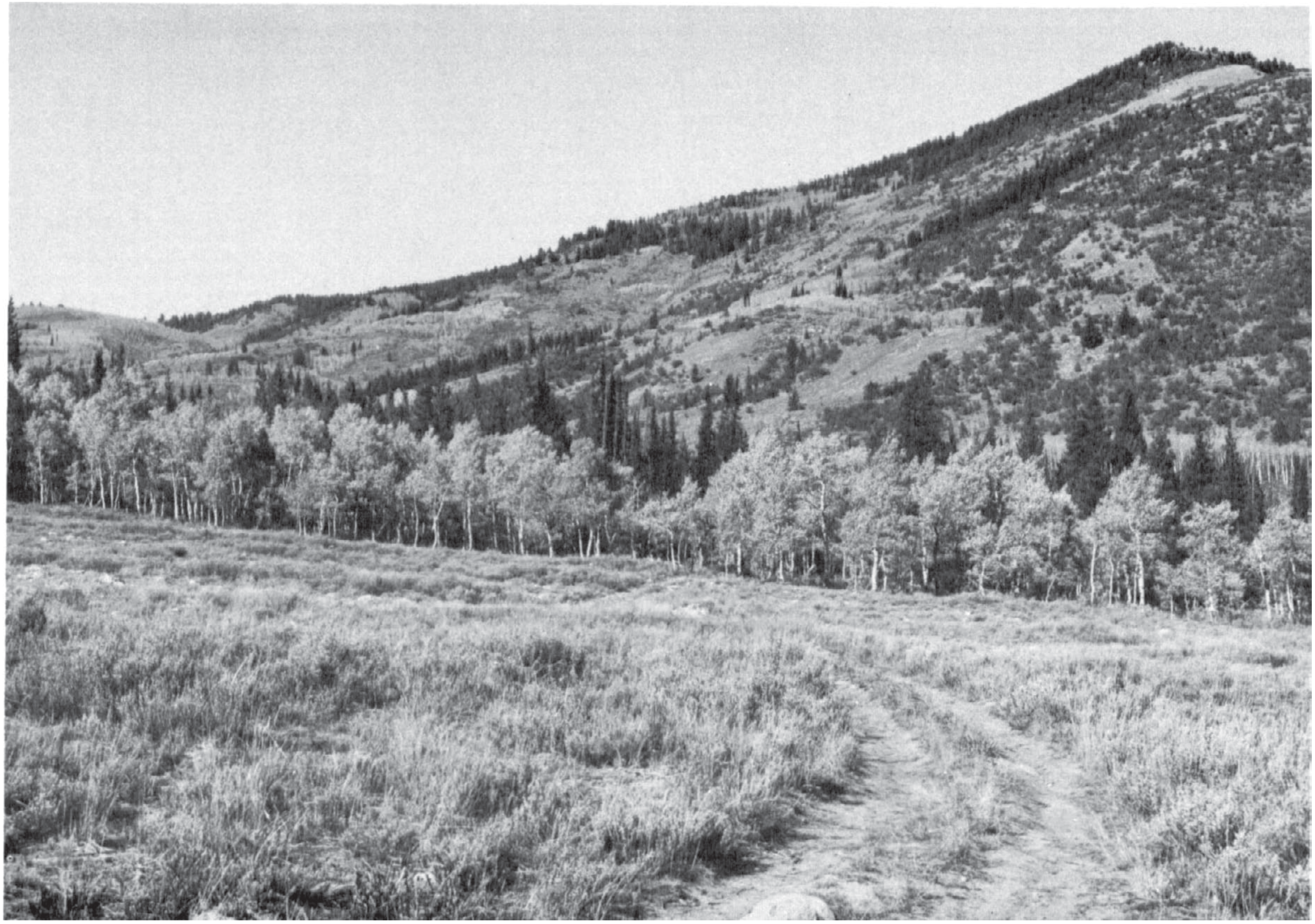

***Figure 16.*—An area used for range. Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded, in Mountain Stony Clay range site, is in the foreground. An area of High Mountain (Aspen) range site is in the upper left-hand side of the picture, and an area of Mountain Shallow Loam range site is in the upper right-hand corner.**

MOUNTAIN STONY LOAM RANGE SITE

This site consists of well-drained and somewhat excessively drained soils on mountains, fans, and ridges. These soils are on all exposures but most commonly have south- and west-facing slopes. Slopes are 1 to 70 percent. Most of these soils have gravel, cobblestones, or stones on the surface. The available water capacity is moderately low to moderate. The permeability is moderately rapid to slow. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

The potential plant community is 50 to 60 percent decreaser grasses, 10 to 15 percent increaser grasses, 2 to 10 percent forbs, and 25 to 35 percent shrubs. Common invaders are cheatgrass, thistle, gumweed, prickly lettuce, and houndstongue. Plant density is 35 to 50 percent. Big sagebrush, bitterbrush, snowberry, serviceberry, and yellowbrush are dominant in most areas of this site and cause a shrubby aspect.

Early and heavy grazing by livestock and wildlife has caused an increase in the undesirable shrubs and a decrease in the better grasses, forbs, and shrubs.

The soils are generally too steep or too stony for any mechanical reseeding or brush control. Spraying of brush with 2, 4-D by aircraft is feasible. Proper range use and rotation-deferred grazing are needed on this site.

The approximate composition of the potential plant community for Mountain Stony Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	40	Bitterbrush	10
Great Basin wildrye	5	Big sagebrush[1]	10
Other grasses	10	Oakbrush[1]	10
Desirable forbs	5	Other shrubs	2
Undesirable forbs[1]	5	Total	100
Birchleaf mountain-mahogany	3		

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,750 to 2,500 pounds of air-dry forage per acre in favorable years and 750 to 1,000 pounds per acre in less favorable years. Approximately 75 percent of this production is from plants that provide forage for livestock and wildlife.

SEMIWET MEADOW RANGE SITE

This site consists of somewhat poorly drained soils on low lake terraces, fans, and flood plains. Slopes are 0 to 10 percent. The water table is most commonly at a depth between 30 and 40 inches.

The potential plant community is 55 to 75 percent decreaser grasses, 15 to 20 percent increaser grasses, 5 to 10 percent forbs, and 0 to 5 percent shrubs. Common invaders are big rabbitbrush, cheatgrass, curlycup gumweed, dandelion, foxtail, greasewood, and Russian-thistle. Plant density is 70 to 80 percent.

This site is managed and grazed together with the Wet Meadow and Alkali Bottom range sites. Because it is somewhat dryer than the other sites, it is overgrazed before the stock use the wetter areas.

Fencing into smaller pastures and establishing a system of rotation and deferred grazing are needed to increase the production and improve the vegetation.

The approximate composition of the potential plant community for the Semiwet Meadow range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Alkali sacaton	5	Peavine	2
Great Basin wildrye	8	Yarrow[1]	2
Idaho fescue	5	Other forbs[1]	4
Sedges	5	Rose	1
Slender wheatgrass	25	Shrubby cinquefoil[1]	1
Tall native bluegrass	5	Silver sagebrush[1]	1
Tufted hairgrass	10	Willows[1]	1
Western wheatgrass	5	Yellowbrush[1]	1
Other grasses and grass-like plants	17	Total	100
Geranium	2		

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,750 to 4,200 pounds of air-dry forage per acre in favorable years and 1,000 to 1,700 pounds per acre in less favorable years. Approximately 90 percent of this production is from plants that provide forage for livestock and wildlife.

UPLAND LOAM RANGE SITE

This site consists of somewhat excessively or well-drained, very gravelly, cobbly, or stony soils. These soils are dominantly on south- and west-facing fans, high lake terraces, and foothills at elevations of 4,600 to 5,700 feet. Slopes are 0 to 50 percent. The available water capacity is moderately low. Permeability is moderate to moderately rapid. Runoff is slow to rapid, and the hazard of erosion is slight to high.

The potential plant community is 60 to 75 percent decreaser grasses, 5 to 10 percent increaser grasses, 5 to 10 percent forbs, and 10 to 20 percent shrubs. Common invaders are cheatgrass, penstemon, Russian-thistle, sunflower, gumweed, juniper, phlox, and snakeweed.

Overgrazing and early grazing have caused a decrease in the better grasses and an increase in big sagebrush, cheatgrass, and annual weeds. An improvement in range condition depends largely on a rotation-deferred system of grazing and on proper range use. The soils are mostly too stony or too steep for reseeding. Spraying with 2, 4-D to control undesirable weeds and big sagebrush is feasible in some areas.

The approximate composition of the potential plant community for the Upland Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	43	Astex[1]	1
Great Basin wildrye	5	Astragalus[1]	1
Indian ricegrass	10	Balsamroot	1
Prairie junegrass	2	Drummond thistle[1]	1
Sandberg bluegrass	5	Lupine[1]	1
Tall native bluegrass	2	Peavine	2
Western wheatgrass	5	Other forbs[1]	3
Other grasses	3	Big sagebrush[1]	4
Bitterbrush	2	Mormon-tea	1
Rubber rabbitbrush[1]	1	Yellowbrush[1]	2
Other shrubs[1]	5	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,300 to 2,500 pounds of air-dry forage per acre in favorable years and 550 to 1,300 pounds per acre in less favorable years. Approximately 85 percent of this production is from plants that provide forage for livestock and wildlife.

UPLAND SHALLOW LOAM RANGE SITE

This site consists of somewhat excessively drained, stony and cobbly soils on south- and west-facing high lake terraces and foothills. Slopes range from 10 to 70 percent. The low available water capacity limits the moisture available for plant growth. Permeability is moderate. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

The potential plant community is 50 to 65 percent decreaser grasses, 5 to 10 percent increaser grasses, 5 to 10 percent forbs, and 15 to 20 percent shrubs. Common invaders are cheatgrass, thistle, gumweed, and snakeweed. Plant density is 35 to 45 percent.

Generally, the range condition of this site is improving. Although former heavy use in spring caused an increase in big sagebrush and yellowbrush and a decrease in bluebunch wheatgrass, young plants of bluebunch wheatgrass and prairie junegrass now are numerous. Spraying the undesirable shrubs and forbs with 2, 4-D increases the production of grasses.

The soils generally are too stony, too steep, and too shallow for reseeding. The better grasses can be increased in vigor and amount by deferring grazing until after seed maturity.

The approximate composition of the potential plant community for the Upland Shallow Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	50	Big sagebrush[1]	10
Sandberg bluegrass	6	Bitterbrush	5
Other grasses	4	Low sagebrush[1]	10
Balsamroot	3	Phlox[1]	3
Phlox	2	Yellowbrush[1]	2
Other forbs	5	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,750 to 2,500 pounds of air-dry forage per acre in favorable years and 700 to 1,500 pounds per acre in less favorable years. Approximately 75 percent of this production is from plants that provide forage for livestock and wildlife.

UPLAND STONY LOAM RANGE SITE

This site consists of well-drained soils on fans, terraces, and foothills at elevations of 4,400 to 6,000 feet. Slopes are 4 to 50 percent. In places the soils are gravelly or cobbly. The available water capacity is moderately high or high. Permeability is moderate to moderately slow. Runoff is slow to rapid, and the hazard of erosion is slight to high.

The potential plant community is 60 to 70 percent grass, 2 to 5 percent forbs, and 20 to 30 percent shrubs. Common invaders are cheatgrass, Russian-thistle, gumweed, big rabbitbrush, and snakeweed. Plant density is 40 to 50 percent.

Heavy grazing or early grazing has caused a decrease in production in some areas. Big sagebrush, cheatgrass, and weeds are dominant in the plant community in some low-producing areas.

The soils in this site are well suited to range improvement practices, spraying with 2, 4-D to control bushes and weeds, and proper range use. Slopes up to 30 percent can be reseeded.

The approximate composition of the potential plant community for the Upland Stony Loam range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Bluebunch wheatgrass	62	Birchleaf mountain-mahogany	2
Indian ricegrass	3	Bitterbrush	3
Other grasses	5	Black sagebrush	10
Balsamroot	2	Shadscole[1]	5
Phlox[1]	1		
Other forbs[1]	2	Total	100
Big sagebrush[1]	5		

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 1,400 to 2,300 pounds of air-dry forage per acre in favorable years and 750 to 1,400 pounds per acre in less favorable years. Approximately 85 percent of this production is from plants that provide forage for livestock and wildlife.

WET MEADOW RANGE SITE

This site consists of poorly drained soils on flood plains and low lake terraces and in drainageways. Slopes range from 0 to 3 percent. The surface layer is black or nearly black. In places these soils are gravelly and cobbly. The water table generally is within a depth of 20 inches.

The potential plant community is 45 to 55 percent decreaser grasses or grasslike plants, 30 to 40 percent increaser grasses or grasslike plants, 3 to 6 percent forbs, and about 2 percent shrubs. Common invaders on this site are annual weeds, big rabbitbrush, cheatgrass, foxtail, cocklebur, povertyweed, curlycup gumweed, and teasel. Plant density is 85 to 100 percent.

The condition of this range site is considerably lower than its potential. Early and prolonged grazing has resulted in a decrease of the better plants and an increase of foxtail barley and saltgrass. A system of rotation grazing and fencing into smaller pastures is needed. Fertilizer, especially nitrogen, should increase production. Better water control also is needed.

The approximate composition of the potential plant community for the Wet Meadow range site is:

Species	*Percentage by weight*	*Species*	*Percentage by weight*
Sedges	40	Cinquefoil[1]	1
Tufted hairgrass	24	Native clover[1]	1
Wiregrass	10	Other forbs[1]	2
Other grasses and grasslike plants	20	Willows[1]	1
Shrubs[1]	1	Total	100

[1] These plants show little or no use by livestock.

This range site has an estimated total potential production of 4,000 to 6,500 pounds of air-dry forage per acre in favorable years and 3,000 to 3,500 pounds per acre in less favorable years. Approximately 95 percent of this production is from plants that provide forage for livestock and wildlife.

Use of the Soils as Woodland[4]

Wood products are harvested from only a comparatively small acreage in the survey area. The trees that are usable for wood products are mainly Douglas-fir, alpine fir, and aspen. About 15 percent of the survey area, or 80,000 acres, has a cover of aspen or conifers. This acreage is divided about evenly, 50 percent each of aspen and conifers. The soils in woodland are generally too step for cultivated crops, or they occur at high elevations where the climate is too cold for cultivated crops.

Woodland Management and Woodland Suitability Groups

Soil properties have a strong influence on species adaptation, tree growth, and woodland management. Differences in texture and depth of the soil material affect the available water capacity and therefore influence tree growth. Slope and aspect also account for differences in the growth of trees and the way woodland is managed.

As a rule, trees grow fastest and tallest on the better soils. Tree growth is about the same on soils that have similar properties, and for this reason it is possible to group soils for woodland management. A group consists of soils that have comparable potential productivity and limitations, that produce similar crops of wood, and that require similar management. Such a group is called a woodland suitability group of soils.

Potential productivity refers to the capability of the soil to produce wood. The best indicator of soil productivity is the height to which the tallest trees will grow in a stated number of years. This height in feet at a given age is called site index. A grouping of site indexes is called site class. For Douglas-fir, site index is based on the average height of the dominant and condominant trees at the age of 100 years. Potential annual growth for this species was adapted from USDA Technical Bulletin 630(*5*). For aspen, site index is based on the average height of the tallest trees at the age of 80 years. Potential annual growth for this species was obtained from USDA Bulletin 1291(*2*). Trees were measured in study plots in the Cache Area and other places in Utah to obtain data for correlation with published growth tables.

The "Guide to Mapping Units" at the back of this survey shows the woodland suitability group for each mapping unit used as woodland in the Cache Area. Woodland suitability groups are identified by 3-digit symbols, consisting of Arabic numerals and lowercase letters that have meanings as follows:

> *First digit* is a numeral that refers to site class. In the Cache Area, site indexes for Douglas-fir in the range of 84 to 71 are in site class 4 (moderate growth potential); those for aspen in the range

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[4] BENJAMIN B. HEYWOOD, range conservationist, Soil Conservation Service, assisted in the preparation of this section.

of 77 and 68 are in site class 2 (high growth potential).

Second digit is a lowercase letter that refers to a soil characteristic that limits woodland use or management. Letters have the following meaning: c, clayey soils; d, restricted rooting depth; f, gravelly soil; r, slopes; s, sandy soil; w, wet soil; x, stony and rocky soil; and o, no soil limitations.

Third digit is a numeral that indicates the degree of hazard and the kinds of trees to which the soils are suited, as follows: Numerals 1, 2, and 3 show that the soils are suited to needleleaf trees. If the numeral is 1, the soils have no particular limitations; 2, means that the soils have one or more moderate limitations; and 3 means that the soils have one or more severe limitations.

The text that follows describes the five woodland suitability groups of soils in the Cache Area. Numbering of woodland suitability groups is based on a statewide system, and not all groups are represented in the Cache Area. Therefore, numbering is not consecutive. Terms used are defined in the following paragraphs.

Seedling mortality refers to the expected soil-caused mortality for naturally occurring or planted seedlings as follows: *Slight* means that the expected mortality is 0 to 25 percent; *moderate* means that the expected mortality is between 25 and 50 percent; and *severe* means that the expected mortality is greater than 50 percent.

Plant competition refers to the invasion or growth of undesirable plants as follows: *Slight* means that competition will not prevent adequate natural regeneration and early growth nor will it interfere with adequate development of planted seedlings. *Moderate* means that competition will delay natural or artificial regeneration. It will affect both establishment and growth rate of trees, but it will not prevent the eventual development of a fully stocked, normal stand. *Severe* means that competition will prevent adequate natural or artificial regeneration without intensive site preparation and weeding.

Erosion hazard refers to the potential of soil erosion that can occur after timber is cut, as follows: *Slight* means that problems of erosion control are unimportant; *moderate* means that some attention must be given to control unnecessary soil erosion; and *severe* means that intensive treatments, specialized equipment, and methods of operation must be planned to minimize soil deterioration.

Windthrow hazard is an evaluation of soil characteristics that affect windfirmness as follows: *Slight* means that normally no trees are blown down by wind. *Moderate* means that some trees are expected to blow down during periods of excessive soil wetness and high wind. *Severe* means that many trees are expected to blow down in areas of wet soil during periods of moderate or high wind.

Equipment limitations refer to restrictions in the use of woodland equipment because of soil-related conditions, as follows: *Slight* means that use of equipment is not restricted in kind or time of year. *Moderate* means that use of equipment is moderately restricted in kind of operations by one or more of such factors as slope, stones, obstructions, seasonal soil wetness, physical soil characteristics, injury to tree roots, soil structure, and soil stability. *Severe* means that special equipment is needed and its use is severely restricted by one or more of the items listed for "moderate," and by safety in operation.

WOODLAND SUITABILITY GROUP 2o1

The soils in this group are well drained. Most of them are gravelly, cobbly, or stony on the surface, in the profile, or both. Slopes range from 6 to 30 percent. These soils are on mountains, fans, and small valley bottoms. Available water capacity is moderate to high. Permeability is moderate to slow. Average annual precipitation is 22 to 30 inches and is mostly snow. The soils in this group are in the Flygare, Lucky Star, Mult, Red Spur, and Scave series.

These soils are highly productive of aspen (fig. 17), and the site index for this tree ranges from 70 to 77. Potential annual growth per acre is 41 cubic feet per acre.

For this group of soils, seedling mortality and the windthrow hazard are slight. Plant competition is moderate. Equipment limitations are moderate. The hazard of erosion is slight.

WOODLAND SUITABILITY GROUP 2r1

The soils in this group are well drained. Most of them are gravelly, cobbly, or stony on the surface, in the profile, or both. Slopes range from 30 to 60 percent. These soils are on mountains and fans. The available water capacity is moderate to high. Permeability is moderate to slow. Average annual precipitation is 22 to 30 inches and is mostly snow. The soils in this group are in the Lucky Star and Mult series.

These soils are steep, but they are highly productive of aspen, and the site index for this tree ranges from 75 to 76. Potential annual growth per acre is 40 to 41 cubic feet.

For this group of soils, seedling mortality and windthrow hazard are slight. Plant competition is moderate. Equipment can be used with moderate limitations. The hazard of erosion is moderate.

WOODLAND SUITABILITY GROUP 4o1

The soils in this group are well drained to somewhat excessively drained. They are mostly gravelly, cobbly, or stony. Slopes range from 6 to 40 percent. These soils are on high mountains, and they mainly have slopes that face north and east. Available water capacity is moderate to high. Permeability is moderately rapid to moderate. Average annual precipitation is 25 to 35 inches and is mostly snow. The soils in the group are in the Cluff, Elwood, and Scout series.

These soils are moderately productive of alpine fir and Douglas-fir. The site index is 76 for alpine fir and ranges from 74 to 81 for Douglas-fir. Potential annual growth per acre is 170 feet.

For this group of soils, seedling mortality and the windthrow hazard are slight. Plant competition is moderate. Equipment limitations are slight. The hazard of erosion is slight.

WOODLAND SUITABILITY GROUP 4r1

The soils in this group are well drained to somewhat excessively drained. They are mostly gravelly, cobbly, or stony. Slopes range from 30 to 80 percent. These soils are on high mountains, and they mainly have slopes that

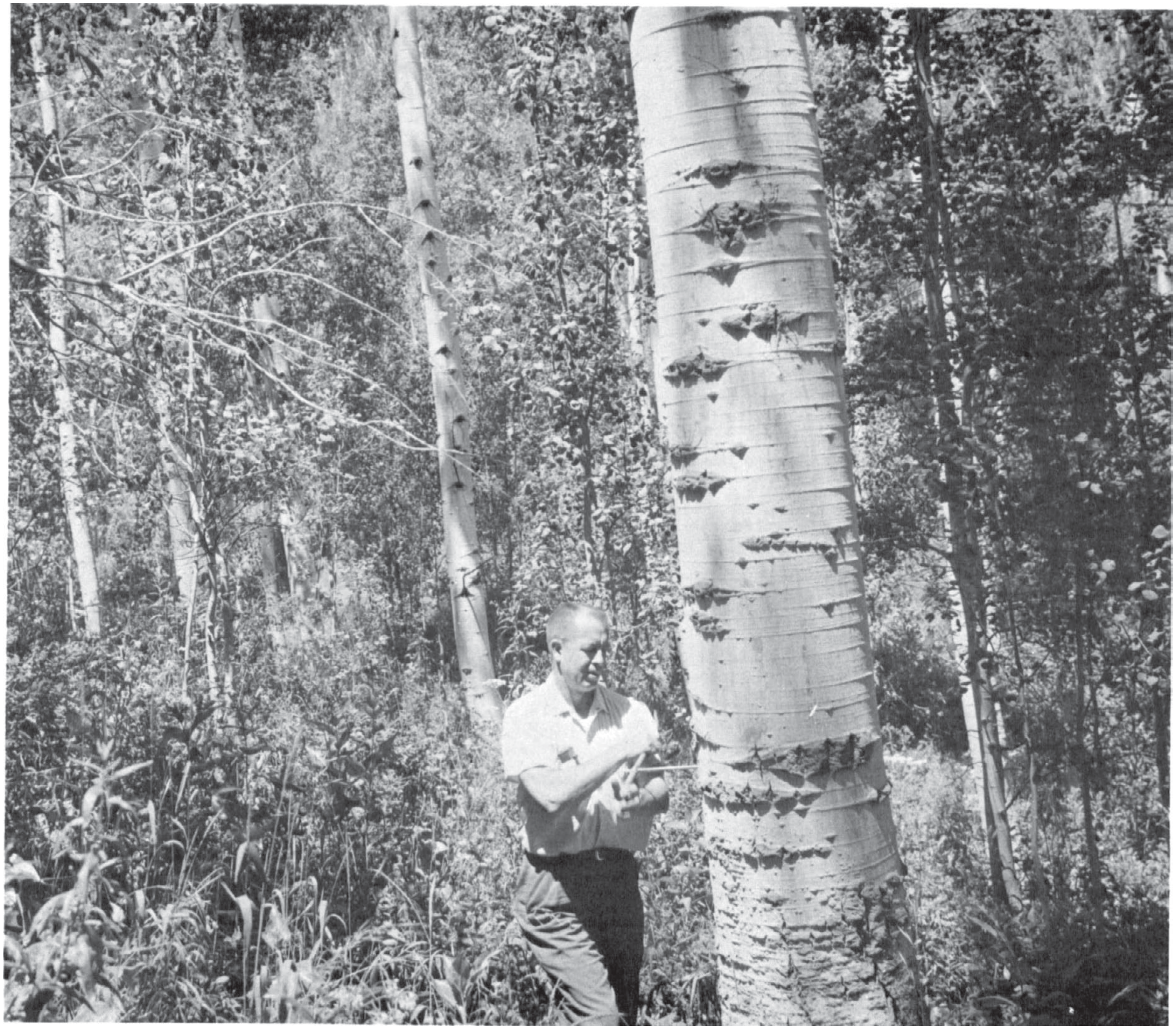

***Figure 17.*—Aspen growing on Lucky Star silt loam, 6 to 30 percent slopes, which is in woodland group 2o1. On this soil the production potential for aspen is high.**

face north and east. Available water capacity is moderate to high. Permeability is moderately rapid to moderate. Average annual precipitation is 25 to 35 inches and is mostly snow. The soils in this group are in the Bickmore, Dateman, Elwood, and Scout series.

These soils are steep, but they are moderately productive of alpine fir and Douglas-fir. Site indexes for these species range from 76 to 82. Potential annual growth per acre ranges from 138 to 171 board feet.

For this group of soils, seedling mortality and the windthrow hazard are slight. Plant competition is moderate. Equipment limitations are moderate. The hazard of erosion is moderate to severe.

WOODLAND SUITABILITY GROUP 4x1

The soils in this group are well drained to somewhat excessively well drained. They are extremely stony or rocky. Slopes are 10 to 80 percent. These soils are on high mountains, and they mainly have slopes that face north and east. Permeability is moderate. Average annual precipitation is 25 to 35 inches and is mostly snow. The soils in this group are in the Dateman and Fitzgerald series.

These soils are moderately productive of alpine fir and Douglas-fir. Site index for these species range from 70 to 81. Potential annual growth per acre ranges from 130 to 144 board feet per acre.

For this group of soils, seedling mortality and windthrow hazard are moderate. Plant competition is moderate. Equipment limitations are severe. The hazard of erosion is slight to severe.

Use of the Soils for Wildlife[5]

Most soils in the Cache Area support vegetation that is used by wildlife to some extent. Most species of wildlife are not confined to areas of a particular soil or group of soils. The presence of wildlife in a given area is dependent upon the availability of food, water, and cover. The suitability of the soil for providing these elements and how the soil is used determine the relative abundance of wild birds and animals.

Natural streams in the survey area provide fishing for local residents and tourists. Some streams are fished the year around. Rainbow, brown, brook, and cutthroat trout reproduce in streams, and the supply is supplemented by stocking. Catfish, carp, suckers, and whitefish are other important species in the local waters. Some fish ponds are privately owned, and there are several commercial fisheries. Most of these are stocked with rainbow trout.

Such small furbearing animals as muskrat, mink, and beaver are trapped in some waters of the Cache Valley and in upland streams. Raising mink is an important source of income.

In this section the wildlife habitat in the Cache Area is discussed in reference to the climatic zones, which are about the same general areas as described for the range sites. The soils are generally placed in four wildlife suitability groups as follows:

WILDLIFE SUITABILITY GROUP 1

This group consists of soils in the Wet and Semiwet climatic zone. These soils receive run-in moisture in addition to precipitation. They are generally deep and somewhat poorly drained or poorly drained. They are moderately coarse textured to fine textured. These soils are nearly level or gently sloping and are on flood plains, fans, or low terraces. The water table generally is within a depth of 40 inches. Some of the soils are ponded, and some are affected by salt and alkali. The soils are in the Airport, Cache, Cardon, Center Creek, Collett, Greenson, Jordan, Kirkham, Lasil, Lewiston, Logan, Nibley, Payson, Provo, Quinney, Roshe Springs, Shay, Salt Lake, Trenton, Winn, and Woods Cross series and Mixed alluvial land.

These soils are near or adjacent to open water in reservoirs, along streams, and around ponds. The vegetation growing on these soils provides food, cover, and escape for wildlife. The vegetation is mainly saltgrass, foxtail, wiregrass, Kentucky bluegrass, native clover, White Dutch clover, four-wing saltbush, teasel, cattails, bulrushes, sedges, alkali sacaton, sagebrush, and willow. Some areas of these soils are cultivated. Diversity of vegetation produces borders that provide food and cover for wildlife.

Ducks, geese, ring-necked pheasant, mourning doves, muskrats, beavers, mink, nongame birds, and small rodents inhabit areas of these soils.

WILDLIFE SUITABILITY GROUP 2

This group consists of soils in the Upland climatic zone. These soils receive 14 to 17 inches of precipitation annually, and temperatures are moderate. The soils range from shallow to deep and are somewhat excessively drained to moderately well drained. They are coarse textured to fine textured. Some of the soils are gravelly, cobbly, and stony. These soils are mostly on intermediate and high lake terraces and deltas of old Lake Bonneville, and on fans. Slopes are 0 to 30 percent. The soils are in the Battle Creek, Blackrock, Collinston, Crookston, Crowshaw, Green Canyon, Hillfield, Hyrum, Kidman, Lakewin, Layton, Leatham, Lewiston, Mendon, Middle, Millville, Munk, Parleys, Parlo, Preston, Richmond, Ricks, Steed, Sterling, Timpanogos, and Wheelon series and Rough broken land and Stony alluvial land.

The vegetation is mainly grasses, but there are scattered shrubs and forbs. The composition is bluebunch wheatgrass, Indian ricegrass, slender wheatgrass, tall native bluegrass, prairie junegrass, Great Basin wildrye, dandelion, cheatgrass, aster, balsamroot, mulesear dock, sunflower, geranium, buckwheat, bitterbrush, big sagebrush, yellowbrush, serviceberry, and snowberry. Most areas of the soils are cultivated and are used for alfalfa, small grain, corn, sugar beets, and orchards. Diversity in vegetation provides borders that are important to wildlife.

Some areas of these soils provide winter range for deer and elk. They also provide habitat for chukar, gray partridge, mourning doves, sage grouse, sharp-tailed grouse, quail, cottontail rabbits, jackrabbits, skunks, and some predators.

WILDLIFE SUITABILITY GROUP 3

This group consists of soils in the Mountain climatic zone. These soils receive 17 to 25 inches of precipitation annually. Winters are cold and snowy. The soils range from shallow to deep and are somewhat excessively drained to well drained. They generally are medium textured to fine textured. Some of the soils are gravelly, cobbly, and stony. These soils are nearly level to very steep, and they occupy rough, mountainous areas and fans. The soils are in the Agassiz, Ant Flat, Avon, Bradshaw, Barfuss, Clegg, Collinston, Curtis Creek, Dagor, Datwyler, Despain, Elzinga, Foxol, Goring, Hendricks, Hiibner, Hoskin, LaPlatta, Lucky Star, Maughan, McMurdie, Mendon, Nebeker, Obray, Picayune, Poleline, St. Marys, Sheep Creek, Smarts, and Yeates Hollow series.

The vegetation is grasses, shrubs, forbs, and some trees. Some of the dominant plants are slender wheatgrass, bluebunch wheatgrass, tall native bluegrass, prairie junegrass, Kentucky bluegrass, Great Basin wildrye, Idaho fescue, cheatgrass, balsamroot, mulesear dock, western coneflower, geranium, cinquefoil, aster, bitterbrush, big sagebrush, yellowbrush, Oregongrape, black sage, cliffrose, snowberry, serviceberry, mountain-mahogany, ceanothus, chokecherry, and maple. Some areas of the soils are cultivated and are used for alfalfa and small grain. These crops provide food and cover for wildlife.

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[5] CLYDE A. SCOTT, biologist, and BENJAMIN B. HEYWOOD, range conservationist, Soil Conservation Service, assisted in the preparation of this section.

Some areas of these soils are important as range for deer and elk in spring and fall. Game birds in these areas are ruffed grouse, blue grouse, sage grouse, pheasant, and chukar. Coyotes, bobcats, weasels, and badgers also are found in these areas.

WILDLIFE SUITABILITY GROUP 4

This group consists of soils in the High Mountain climatic zone. These soils receive 25 to 35 inches of precipitation annually. Temperatures are cold. The soils are shallow to deep, are well drained, and generally are medium textured to fine textured. Most of the soils are gravelly, cobbly, or stony. These soils are sloping to very steep, and they occupy mountainous areas. The soils are in the Bickmore, Cluff, Dateman, Elwood, Fitzgerald, Flygare, Mult, Lucky Star, Scave, Scout, and Red Spur series.

The vegetation is mostly aspen, Douglas-fir, and alpine fir and an understory of grasses, forbs, and shrubs. The main understory plants are wheatgrass, Kentucky bluegrass, geranium, snowberry, elderberry, currants, and chokecherry.

Areas of these soils are the summer range for deer and elk and a few moose or bear. Cougar, bobcat, coyote, mink, blue grouse, ruffed grouse, weasels, and beavers also live in these areas.

Kinds of Wildlife and Their Habitat

Kind of wildlife in the Cache Area and the food, cover, and water resources that support them are discussed in the following paragraphs.

Chukar.—This game bird was introduced from southern Asia. Choice food plants are barley, bristlegrass, cheatgrass, clover, corn, currant, dandelion, oats, pigweed, Indian ricegrass, serviceberry, sunflowers, teasel, timothy, and wheat. Fairly desirable food plants are alfalfa, barnyardgrass, Kentucky bluegrass, chokecherry, and rose. Chukar also eat many insects. Its cover needs are met largely by rocky slopes and steep grasslands.

Mourning dove.—This migratory game bird eats only seeds. It does not eat forage, fruit, or insects. Choice food plants are barnyardgrass, bristlegrass, corn, pigweed, Indian ricegrass, sunflower, and wheat. Fairly desirable plant foods are barley and oats. Maple and orchard trees are favorite nesting sites for doves. They also nest in other trees and on the ground in well-drained sites. Doves must have drinking water daily.

Ducks.—The surface-feeding mallard, pintail, and widgeon live on field grains and aquatic food. Foods in summer include some insects. Foods in winter are chiefly plant seeds and green forage. The choice food plants are barley, barnyardgrass, bulrush, corn, and wheat. Fairly desirable foods are clover, dandelion, peas, and oats. Ducks are attracted most readily to seeds that are covered with shallow water. Nesting occurs near streams, marshes, lakes, and ponds.

Geese.—Foods favored by geese include green forage plants, such as alfalfa, barley, Kentucky bluegrass, clovers, dandelion, rye, timothy, and wheat. The seeds of alfalfa, barley, barnyardgrass, corn, rye, and wheat also are choice foods. Fairly desirable foods are bulrush, cheatgrass, oats, and pigweed.

Gray partridge.—This European game bird was introduced in the Cache Area about 1930. Its habitat is close to grain fields and rangelands. Choice plant foods are barley, barnyardgrass, bristlegrass, teasel, and wheat. Fairly desirable plant foods are alfalfa, cheatgrass, corn, dandelion, oats, pigweed, Indian ricegrass, rose, sunflower, and timothy. Gray partridge also eat insects. Vegetation for nesting and cover is alfalfa, the grassy plants in fencerows, and the plants in weed patches.

Ring-necked pheasant.—This game bird, a native of China, was successfully introduced in the Cache Area in the early 1900's. Its favorite habitat is diversified croplands that have adjacent cover such as cattails, shrubs, or trees along fencerows and streams and other water courses. Choice plant foods are the seeds of barley, barnyardgrass, bristlegrass, corn, oats, pigweed, Indian ricegrass, teasel, and wheat. Fairly desirable foods are alfalfa, Kentucky bluegrass, chokecherry, clovers, currants, dandelion, raspberry, rose, serviceberry, and sunflowers. Pheasants also eat grasshoppers and other insects.

Quail.—This native game bird's choice foods are chiefly seeds. Green forage and seeds from barley, barnyardgrass, Kentucky bluegrass, chokecherry, corn, oats, pigweed, Indian ricegrass, sunflower, teasel, and wheat also are important. Fairly desirable foods are alfalfa, bristlegrass, cheatgrass, clovers, dandelion, rose, and timothy. Quail roost in shrubs and trees and use shrubby thickets for daytime cover.

Nongame birds.—Many kinds of nongame birds live in the survey area. They, like the game birds, thrive best where their choice foods and adequate nesting sites are available. Robins and a few others eat insects, worms, and fruit. Flycatchers, hawks, herons, seagulls, and swallows live almost entirely on fish, frogs, insects, worms, rodents, and snakes. Crows, magpies, and starlings live on other animal foods, fruit, and seed.

Deer and elk.—These big game animals have seasonal variation in their choice of foods. Browse is preferred during summer, fall, and early in winter, but grass makes up much of their diet late in winter and in spring. Elk are more of a grazing animal than are deer.

Engineering Uses of the Soils [6]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Some of those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are slope and depth to the water table and to bedrock. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

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[6] C. E. BIGLER, civil engineer, Soil Conservation Service, helped to prepare this section.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

It should be emphasized that the interpretations made in this survey are not a substitute for the sampling and testing needed at a site chosen for specific engineering work that involves heavy loads or at a site where excavations are deeper than the depths of layers here reported. Also, engineers should not apply specific values to the estimates for bearing capacity given in this survey. Nevertheless, by using this survey, an engineer can select and concentrate on those soils most important for his proposed kind of construction, and in this manner reduce the number of soil samples taken for laboratory testing and complete an adequate soil investigation at minimum cost.

Information of value in planning engineering work is given throughout the text, especially in sections "Descriptions of the Soils" and "Formation and Classification of Soils." Some terms used by the soil scientist may be unfamiliar to the engineer, and some words—for example, clay, silt, and sand—may have special meaning in soil science. These and other special terms used in the soil survey are defined in the Glossary at the back of this survey.

Most of the information in this section is presented in tables 3, 4, and 5, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples. This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in these tables. It also can be used to make other useful maps.

Engineering Classification Systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*11*) used by Soil Conservation Service engineers, the Department of Defense, and others, and the AASHO system (*1*) adopted by the American Association of State Highway Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example ML-CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 6; the estimated classification, without group index numbers, is given in table 4 for all soils mapped in the survey area.

Estimated Engineering Properties

The estimated soil properties significant to engineering are shown in table 3. Information obtained during the soil survey and knowledge of the individual soils of the survey area were used as a basis for the estimates in this table.

The meaning of hydrologic groups shown in table 3 may not be familiar to some persons who use this survey. These data are used in estimating the total volume and peak runoff that can be expected from storms of a given amount and intensity. The data are useful in planning measures to control water.

In group A are coarse textured and moderately coarse textured soils that transmit water through their profile at a rapid rate. These soils absorb the precipitation that falls in most storms, and they have the highest rate of infiltration, even when they are thoroughly wet, and the lowest runoff potential.

In group B are the moderately coarse textured to moderately fine textured, deep or very deep soils that transmit water through their profile at a moderate rate. These soils have a moderate runoff potential.

In group C are the moderately coarse textured to fine-textured, deep to shallow soils that transmit water through their profile at a slow rate. These soils have a high runoff potential.

In group D are the medium-textured, moderately fine textured, and fine textured soils. Some soils in this group have a high water table, some have a thin mantle of soil over impervious material, some have a surface layer consisting of impervious material, and some are very deep. Soils in group D have the highest runoff potential of any soils in the survey area.

TABLE 3.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil, which may in the first colum of this table. The symbol >

Soil series and map symbols	Depth to seasonal water table[1][2]	Depth to bedrock	Hydrologic group[1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
*Agassiz: AAE, AAG2, ABG2, ADG2, AEG2, AGE, AGG2. For properties of Bradshaw soil in ABG2, of Dateman soil in ADG2, of Elwood soil in AEG2, and of Goring soil in AGE and AGG2, refer to their respective series.	--------	10–20	D	0–18	Very cobbly silt loam and very cobbly silty clay loam.	GM or ML	A-4 or A-2
				18	Fractured limestone bedrock.		
*Airport: AhA, Ak, Am. For properties of Salt Lake soil in Am, refer to the Salt Lake series.	0–40	>60	D	0–60	Silt loam, silty clay loam, clay loam, or loam.	CL or ML	A-4 or A-6
*Ant Flat: AND, AOE2. For properties of Despain soil in AOE2, refer to the Despain series.	--------	40–60+	C	0–11	Loam or clay loam	CL or ML	A-4 or A-6
				11–60	Clay to clay loam	CH or CL	A-7 or A-6
*Avon: ArA, ArB, ArC, ArD, AsC, AsE. For properties of Collinston soil in AsC and AsE, refer to the Collinston series.	--------	>60	B	0–12	Silty clay loam	ML or CL	A-4 or A-6
				12–27	Silty clay	CL	A-6
				27–60	Silty loam or silty clay loam.	CL or ML	A-6 or A-4
*Barfuss: BAF. For properties of Leatham soil, refer to the Leatham series.	--------	>60	B	0–60	Silty clay loam and silt loam.	CL or ML	A-4 or A-6
Battle Creek: BcA, BcD	--------	>60	C	0–72	Silty clay	CL or CH	A-7
*Bickmore: BGG, BKG2, BLG2. For properties of Agassiz soil in BKG2, and of Sheep Creek soil in BLG2, refer to their respective series.	--------	40	C	0–16	Gravelly silt loam	ML	A-4
				16–37	Cobbly silty clay loam and very cobbly silty clay loam.	GM or ML	A-4 or A-2
				37	Bedrock.		
Blackrock: BmB, BmC, BmD, BnD	--------	>60	B	0–60	Gravelly loam and gravelly clay loam.	SM or ML	A-4
*Bradshaw: BSG2. For properties of Agassiz soil, see Agassiz series.	--------	>60	B	0–14	Silt loam	ML or CL	A-4
				14–60	Cobbly loam and very cobbly loam.	ML or GM	A-4
Cache: Ca	0–20	>60	D	0–72	Silty clay	CH	A-7
Cardon: Cd	30 (40–60)	>60	D (B)	0–62	Silty clay	CH	A-7
Center Creek: CE	[3] 20–40	>60	B	0–15	Silt loam and silty clay loam.	CL or OL	A-7
			C	15–60	Stratified silty clay loam, very fine sandy loam.	CL or ML	A-6
Clegg: CFE	--------	>60	B	0–20	Silt loam and loam	ML	A-4
				20–60	Very cobbly very fine sandy loam.	GM	A-2
*Cluff: CGE, CHE, CIE. For properties of Lucky Star soil in CHE, and of Scout soil in CIE, refer to their respective series.	--------	>60	B	0–9	Silt loam	ML or SM	A-4
				9–31	Very gravelly loam	GM	A-2
				31–62	Very gravelly clay loam.	GC	A-2

See footnotes at end of table.

significant to engineering

have different properties and limitations. For this reason the reader should follow carefully the instructions for referring to other series means more than, and the symbol < means less than]

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
30-60	50-80	30-70	25-60	0. 63-2. 0	0. 08-0. 12	6. 6-7. 8	None	Low.
0	100	100	50-90	<0. 2	0. 12-0. 15	7. 9-9. 6	Slight to severe	Moderate.
0	100	90-100	70-85	0. 20-0. 63	0. 16-0. 20	6. 1-7. 3	None	Moderate.
0	100	85-100	70-90	0. 06-0. 20	0. 14-0. 18	6. 1-8. 4	None	High.
0	100	100	75-95	0. 63-2. 0	0. 18-0. 20	6. 6-7. 3	None	Moderate.
0	100	100	85-95	0. 20-0. 63	0. 15-0. 17	6. 6-7. 8	None	High.
0	100	60-90	75-95	0. 63-2. 0	0. 18-0. 20	7. 9-8. 4	None	Moderate.
0	100	100	75-95	0. 20-0. 63	0. 18-0. 21	6. 6-9. 0	None	Moderate.
0	100	100	90-100	0. 06-0. 20	0. 15-0. 17	6. 6-8. 4	None	High.
0-15	60-90	50-85	50-80	0. 63-0. 20	0. 14-0. 16	6. 1-7. 3	None	Low.
25-40	30-80	25-70	15-60	0. 63-0. 20	0. 10-0. 12	5. 6-8. 4	None	Low.
0-5	55-80	50-75	35-50	0. 63-2. 0	0. 14-0. 16	6. 6-7. 8	None	Low.
0	80-100	75-100	60-75	0. 63-2. 0	0. 18-0. 20	6. 1-7. 3	None	Low.
25-40	40-80	25-65	35-60	0. 63-6. 3	0. 08-0. 12	6. 6-8. 4	None	Low.
0	100	100	90-100	<0. 063	0. 04-0. 06	7. 4-9. 0	Very severe	High.
0	100	100	90-100	<0. 063	0. 15-0. 17	7. 5-9. 0	None	High.
0	100	100	90-95	0. 20-0. 63	0. 20-0. 25	5. 6-7. 3	None	Moderate.
0	100	100	20-90	0. 20-0. 63	0. 18-0. 22	6. 1-7. 3	None	Moderate.
0	100	90-100	80-95	0. 63-2. 0	0. 18-0. 20	6. 1-6. 5	None	Low.
15-40	40-60	20-40	15-35	0. 63-2. 0	0. 07-0. 10	6. 6-7. 8	None	Low.
0	85-100	60-100	45-75	0. 63-2. 0	0. 15-0. 20	5. 6-6. 5	None	Low.
10-30	50-75	40-50	25-35	0. 63-2. 0	0. 08-0. 10	5. 1-6. 5	None	Low.
10-30	40-55	35-50	25-35	0. 63-2. 0	0. 09-0. 11	5-1-6. 4	None	Moderate.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table [1] [2]	Depth to bedrock	Hydrologic group [1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
Collett: Ck	20–36 (40–60)	>60	C	0–60	Heavy silty clay loam	CL	A–6 or A–7
Collinston: ClA, CmC, CmD, CmE2	--------	>60	B	0–60	Loam, silt loam, and clay loam.	ML	A–4
Crookston: CoA, CoB, CoC	--------	>60	B	0–60	Loam and fine sandy loam.	CL or ML	A–4
Crowshaw: CrB, CrC, CrD	--------	>60	B	0–60	Gravelly loam	SM or ML	A–4
*Curtis Creek: CSE, CSG. For properties of Goring soil, refer to the Goring series.	--------	13–20	D	0–18	Loam and sandy clay loam.	ML	A–4
				18	Fractured and weathered sandstone.		
Dagor: DaC, DaD	--------	>60	B	0–60	Silt loam	ML	A–4
*Dateman: DEG, DHG. For properties of Bradshaw soil in DHG, refer to the Bradshaw series.	--------	26–40	C	0–24	Cobbly silt loam	ML	A 4
				24–34	Very cobbly silty clay loam.	GM	A–2 or A–4
				34	Fractured and weathering limestone bedrock.		
*Datwyler: DLG, DNG. For properties of Elzinga and Maughan soils in DNG, refer to their respective series.	--------	32–40	C	0–35	Very cobbly clay and very cobbly sandy clay loam.	GC	A–2 or A–6
				35	Fractured limestone bedrock.		
*Despain: DPG, DSG. For properties of Bickmore soil in DPG, and of Lucky Star soil in DSG, refer to their respective series.	--------	>60	B	0–16	Gravelly loam or loam	ML	A–4
				16–60	Gravelly clay loam and gravelly loam.	GM, GC, or CL	A–4 or A–2
*Elwood: EDG, EGE, EME, EMG. For properties of Agassiz soil in EGE, and of Mult soil in EME and EMG, refer to their respective series.	--------	20–40	C	0–11	Silt loam	ML	A–4
				11–38	Cobbly silty clay loam and very cobbly silty clay loam.	GM or ML	A–2
				38	Fractured limestone.		
Elzinga. Mapped only with the Datwyler and Hoskins soils.	--------	>60	B	0–22	Silt loam	ML or OL	A–4
				22–48	Cobbly silt loam	GM or ML	A–4
				48–62	Mixed very cobbly very fine sandy loam and very cobbly clay loam.	GM	A–2
				62	Fractured sandstone.		
Fitzgerald: FGD	--------	>60	B	0–37	Extremely stony loam and very gravelly sandy clay loam.	GM	A–2 or A–4
				37–60	Very gravelly fine sandy loam.	GM	A–2
Flygare: FLD	--------	>60	B	0–27	Silt loam or cobbly silt loam.	OL or ML	A–4
				27–65	Cobbly sandy clay loam and very cobbly sandy loam.	SM or ML	A–4 or A–2

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
0	100	95–100	85–100	0. 06–0. 20	0. 18–0. 21	7. 4–8. 4	None to slight	High.
0	100	85–100	70–90	0. 63–2. 0	0. 16–0. 18	7. 4–8. 4	None	Low.
0	100	95–100	50–70	0. 63–2. 0	0. 16–0. 18	7. 4–7. 8	None	Low.
0	55–80	50–75	35–55	0. 63–2. 0	0. 12–0. 14	6. 1–7. 3	None	Low.
0–5	10–95	60–90	55–70	0. 63–2. 0	0. 12–0. 16	5. 6–7. 3	None	Low.
0	90–100	70–95	60–90	0. 63–2. 0	0. 18–0. 20	6. 8–7. 3	None	Low.
15–40	60–90	55–85	50–80	0. 63–2. 0	0. 11–0. 14	6. 6–7. 3	None	Low.
20–50	35–55	30–50	15–45	0. 63–2. 0	0. 08–0. 10	7. 4–7. 8	None	Low.
20–50	25–55	20–50	15–45	0. 20–0. 63	0. 08–0. 10	6. 1–9. 0	None	Low to moderate.
10–15	75–95	70–90	50–70	0. 63–2. 0	0. 13–0. 16	6. 1–7. 8	None	Low.
10–15	40–80	35–75	25–60	0. 63–2. 0	0. 10–0. 14	6. 1–8. 4	None	Moderate.
0	85–100	80–95	70–85	0. 63–2. 0	0. 16–0. 18	5. 6–6. 5	None	Low.
10–40	40–80	35–70	25–60	0. 63–2. 0	0. 10–0. 14	6. 1–7. 3	None	Low.
0	100	90–100	80–90	0. 63–2. 0	0. 20–0. 24	5. 6–6. 5	None	Low.
10–25	50–80	40–70	35–60	2. 0–6. 3	0. 11–0. 15	5. 6–6. 5	None	Low.
20–50	50–70	40–50	20–35	2. 0–6. 3	0. 10–0. 12	5. 6–6. 5	None	Low.
15–50	30–85	25–80	20–50	0. 63–2. 0	0. 08–0. 16	5. 1–6. 5	None	Low.
10–35	20–60	10–50	10–35	>6. 3	0. 07–0. 10	5. 1–6. 5	None	Low.
0	70–100	50–100	40–80	0. 63–2. 0	0. 17–0. 25	6. 0–6. 5	None	Low.
10–40	50–80	40–70	25–60	0. 63–2. 0	0. 11–0. 14	5. 6–6. 5	None	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table[1][2]	Depth to bedrock	Hydrologic group[1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
Foxol: FOG	--------	14–20	D	0–17	Gravelly loam, very gravelly loam, and very gravelly sandy loam.	GM or SM	A–4 or A–2
				17	Fractured quartzite rock.		
*Goring: GGE, GOE2 For properties of Obray soil in GOE2, refer to the Obray series.	--------	>60	C	0–60	Heavy silty clay loam and silty clay.	CL or CH	A–7
Gravel pit: Gp. No valid estimates can be made.							
Green Canyon: GrA, GrB	--------	>60	B	0–16	Gravelly loam	ML	A–4
				16–60	Very gravelly fine sandy loam and very gravelly loamy sand.	GM	A–1
Greenson: GsA, GsB, GsC, GuA, GvA	30–40 (40–60)	>60	C (B)	0–72	Loam or silt loam	ML	A–4
Hendricks: HdA, HdB, HdC, HdD	--------	>60	B	0–60	Silt loam and silty clay loam.	CL or ML	A–6 or A–4
Hiibner: HeC, HeD, HeE, HfE	--------	>60	C	0–60	Very cobbly clay	GC	A–6 or A–2
*Hillfield: HgE2, HhE2 For properties of Timpanogos soil in HhE2, refer to the Timpanogos series.	--------	>60	B	0–60	Stratified silt loam and sandy loam.	ML or SM	A–4
*Hoskin: HIB, HKG2, HLG2, HMG2, HNG, HOG2, HSG2. For properties of Datwyler soil in HLG2, of Elzinga soil in HMG2, of Scave soil in HNG, of Scout soil in HOG2, and of Smarts soil in HSG2, refer to their respective series.	--------	24–40	C	0–28	Very cobbly loam	GM	A–2 or A–4
				28	Consolidated, weathering conglomerate.		
Hyrum: HuC, HuE, HyC	--------	>60	B	0–17	Gravelly loam	ML	A–4
				17–60	Very cobbly clay loam and very cobbly loam.	GM	A–2 or A–1
*Jordan: Jo, Jr For properties of Lasil soil in Jr, refer to the Lasil series.	30–48	>60	D	0–68	Silty clay and silty clay loam.	CH or MH	A–7
Kidman: KdA, KdD, KfA, KfB, KfC	40–60+	>60	B	0–43	Fine sandy loam	SM	A–4
				43–60	Fine sandy loam to fine sand.	SM	A–2 or A–1
*Kirkham: Ks, Kt For properties of Shay soil, refer to the Shay series.	30–50	>60	C	0–60	Stratified silty clay loam and silt loam.	CL or ML	A–4 or A–7
Lakewin: La	--------	>60	A	0–34	Gravelly coarse sandy loam and gravelly loamy sand.	SM–SP or SM	A–1 or A–2
				34–60	Very gravelly sand	GP–GM or GM	A–1

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve— No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
				Inches per hour	*Inches per inch of soil depth*	*pH*		
5–25	45–80	35–70	20–50	0. 63–2. 0	0. 08–0. 10	5. 6–6. 5	None	Low.
0	100	80–100	70–95	0. 06–0. 20	0. 14–0. 20	6. 1–7. 3	None	High.
0	70–90	60–80	50–70	2. 0–0. 63	0. 12–0. 14	7. 9–8. 0	None	Low.
5–15	50–70	20–50	10–25	6. 3–20. 0	0. 03–0. 05	7. 9–9. 0	None	Low.
0	100	100	60–90	0. 63–2. 0	0. 15–0. 19	7. 4–9. 0	None	Moderate.
0	100	85–100	80–95	0. 63–2. 0	0. 18–0. 20	6. 1–7. 3	None	Moderate.
0–50	30–60	25–50	20–45	0. 06–0. 20	0. 08–0. 10	6. 1–7. 8	None	Moderate.
0	100	90–100	40–80	0. 63–2. 0	0. 12–0. 17	7. 4–8. 4	None	Low.
10–40	30–65	20–50	15–40	2. 0–6. 3	0. 07–0. 10	6. 1–7. 3	None	Low.
5–10	75–85	60–80	50–75	2. 0–6. 3	0. 12–0. 14	6. 6–7. 3	None	Low.
15–60	35–65	20–50	20–35	0. 63–2. 0	0. 08–0. 10	6. 6–7. 8	None	Low.
0	100	100	90–100	<0. 06	0. 03–0. 05	7. 9–9. 6	Severe to very severe.	High.
0	100	100	35–50	2. 0–6. 3	0. 13–0. 50	6. 6–8. 4	None	Low.
0	100	100	10–35	2. 0–6. 3	0. 09–0. 11	7. 9–9. 0	None	Low.
0	100	100	60–95	0. 20–0. 63	0. 18–0. 20 (0. 08–0. 10 in Kt).	7. 4–9. 0	None to moderate.	Moderate.
0	55–85	50–80	10–30	6. 3–20. 0	0. 05–0. 07	6. 6–7. 8	None	Low.
0	15–55	10–50	5–20	>20	0. 03–0. 05	7. 4–9. 0	None	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table [1] [2]	Depth to bedrock	Hydrologic group [1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
*LaPlatta: LCG, LGE For properties of Obray soil in LGE, refer to the Obray series.	--------	>60	B	0–60	Clay, silty clay, and silty clay loam.	CH or CL	A–7 or A–6
Lasil Mapped only with soils of the Jordan series.	32–40	>60	D	0–60	Heavy silty clay loam	CH	A–7
Layton: Lh	40–60	>60	A	0–66	Loamy fine sand	SM	A–2
*Leatham: LMG2 For properties of Barfuss soil, refer to the Barfuss series.	--------	>60	B	0–60	Silt loam and silty clay loam.	ML or CL	A–4 or A–6
Lewiston: Ln, Lo	10–30 (30–40)	>60	C (B)	0–32	Fine sandy loam	SM or ML	A–2 or A–4
				60	Stratified loamy fine sand.	SM	A–2 or A–4
Logan: Lr	0–40 (40–60)	>60	D (C)	0–60	Heavy silty clay loam and silty clay.	CL or CH	A–7
*Lucky Star: LSE, LTG, LUE, LVE, LWE, LXE. For properties of Goring soil in LUE, of Hoskin soil in LVE, of Red Spur soil in LWE, and of Scout soil in LXE, refer to their respective series.	--------	>60	B	0–13	Silt loam, gravelly silt loam, or extremely stony silt loam.	OL, ML, or SM	A–4
				13–72	Very cobbly fine sandy loam and very cobbly sandy clay loam.	GM or SM	A–2
*Maughan: MAG For properties of Datwyler soil, refer to the Datwyler series.	--------	>60	B	0–25	Silt loam	OL or ML	A–4
				25–60	Cobbly clay	CH or CL	A–7 or A–6
*McMurdie: McA, McB, McC, MdE2 For properties of Hillfield soil in MdE2, refer to the Hillfield series.	--------	>60	B	0–14	Silt loam and silty clay loam.	CL or ML	A–4
				14–60	Silty clay, silty clay loam, and sandy loam.	CH or CL	A–7 or A–6
*Mendon: MeA, MeB, MeC, MfB, MfE2. For properties of Collinston soil in MfB and MfE2, refer to the Collinston series.	--------	>60	B	0–60	Clay loam and loam	CL or ML	A–7 or A–6
Middle Mapped only with soils of the Richmond series.	--------	24–40	C	0–28	Cobbly loam and very cobbly loam.	GM	A–2 or A–4
				28	Bedrock.		
Millville: MIA, MIB	[4] 40–50	>60	B	0–65	Silt loam	ML	A–4
Mixed alluvial land: Mm. No valid estimates can be made.							
*Mult: MNE, MNG2, MSE For properties of Agassiz soil in MNE and MNG2, and of Lucky Star soil in MSE, refer to their respective series.	--------	22–40	C	0–24	Silt loam and silty clay loam.	ML or CL	A–4 or A–6
				24	Fractured limestone rock.		

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
0	100	100	85–95	0. 20–0. 63	0. 16–0. 20	6. 1–9. 0	None	High.
0	100	100	90–100	<0. 06	0. 05–0. 10	6. 6–9. 6	Slight to severe	High.
0	100	90–100	10–25	6. 3–20. 0	0. 09–0. 11	6. 6–8. 4	None	Low.
0	100	95–100	80–95	0. 63–2. 0	0. 18–0. 20	6. 6–8. 6	None	Moderate.
0	100	100	25–60	2. 0–6. 3	0. 13–0. 15	7. 4–9. 0	None to moderate	Low.
0	100	100	15–50	0. 63–6. 3	0. 08–0. 12	8. 5–9. 6	Severe to moderate.	Low.
0	100	100	85–100	0. 06–0. 20	0. 15–0. 17	7. 4–8. 4	None to slight	High.
5–10	60–90	55–85	40–75	0. 63–2. 0	0. 17–0. 25	6. 0–6. 8	None	Low.
25–40	50–70	45–65	15–35	0. 63–2. 0	0. 08–0. 10	5. 6–7. 3	None	Low.
0	95–100	85–100	75–90	0. 63–2. 0	0. 20–0. 22	5. 0–6. 5	None	Low.
10–25	60–90	50–80	35–65	0. 20–0. 63	0. 12–0. 14	6. 1–7. 3	None	High.
0	100	90–100	70–95	0. 20–0. 63	0. 18–0. 21	6. 6–7. 3	None	Moderate.
0	100	95–100	80–95	0. 20–0. 63	0. 16–0. 18	6. 6–7. 8	None	High.
0	100	100	75–95	0. 20–0. 63	0. 18–0. 21	6. 6–8. 4	None	Moderate.
15–50	40–60	30–50	25–40	0. 63–2. 0	0. 08–0. 12	6. 6–8. 4	None	Low.
0	100	100	70–90	0. 63–2. 0	0. 16–0. 20	7. 4–8. 4	None	Low.
0	90–100	80–100	70–90	0. 63–2. 0	0. 18–0. 20	5. 6–7. 3	None	Moderate.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table [1] [2]	Depth to bedrock	Hydrologic group [1]	Depth from surface (representative profile)	Classification: USDA texture	Classification: Unified	Classification: AASHO
	Inches	*Inches*		*Inches*			
*Munk: MoG2 For properties of Blackrock soil, refer to the Blackrock series.	--------	20–40	C	0–36	Gravelly loam and very gravelly loam.	GM	A-1, A-2, or A-4
				36	Salt Lake Geologic Formation materials, partially consolidated.		
Nebeker: NbB, NbC, NbE	--------	>60	B	0–14	Silt loam	ML or CL	A-4 or A-6
				14–70	Clay or heavy silty clay loam.	CL or CH	A-7
Nibley: NcA, NcB	30-40 (50–60)	>60	C	0–60	Silty clay and heavy silty clay loam.	CH or CL	A-7
Obray: ObB	--------	>60	D	0–60	Silty clay	CH	A-7
Parleys: PaA, PaB, PaC	--------	>60	B	0–68	Silt loam and clay loam.	CL or ML	A-6 or A-4
Parlo: PIA, PIB, PIC	--------	>60	B	0–30	Silt loam and silty clay loam.	CL or ML	A-6 or A-4
				30–60	Very gravelly loamy sand.	GM	A-1
Payson: Pn	30–50	>60	D	0–60	Silty clay	CL or CH	A-7 or A-6
*Picayune: POG2, PRG For properties of Agassiz soil in POG2, and of Smarts soil in PRG, refer to their respective series.	--------	>60	B	0–60	Gravelly clay loam	SM or ML	A-4
*Poleline: PSG2 For properties of Agassiz soil, refer to the Agassiz series.	--------	40–60+	B	0–60	Gravelly to very gravelly loam.	ML or SM	A-4
Preston: PtC	--------	>60	A	0–64	Fine sand	SM or SP-SM	A-3 or A-2
Provo: Pu, Pv	26–36 (50–60)	>60	C (A)	0–13	Gravelly loam	SM	A-4
				13–60	Very gravelly loam and very gravelly sandy loam.	GM	A-1
Quinney: Qu	30–50	>60	B	0–39	Silt loam and loam	ML	A-4
				39–60	Silty clay	CL	A-6
*Red Spur Mapped only with soils of the Lucky Star series.	--------	48-60+	B	0–48	Loam and fine sandy loam.	ML or SM	A-4 or A-2
				48–56	Cobbly sandy clay loam.	CL or SC	A-4
				56	Bedrock.		
*Richmond: RCG2, RDG2, REG2, RFG2, RGG2. For properties of Middle soil in RDG2, of Munk soil in REG2, of Nebeker soil in RFG2, and of Sterling soil in RGG2, refer to their respective series.	--------	10–20	D	0–18	Very stony loam and very cobbly loam.	GM or ML	A-2
				18	Fractured bedrock.		

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
5–15	50–70	20–50	10–50	0. 63–2. 0	0. 08–0. 10	7. 4–9. 0	None	Low.
0	90–100	90–100	70–90	0. 63–2. 0	0. 16–0. 20	5. 6–7. 3	None	Moderate.
0	90–100	90–100	80–95	0. 20–0. 63	0. 15–0. 20	6. 1–7. 8	None	High.
0	100	100	85–95	0. 06–0. 20	0. 16–0. 18	6. 6–9. 0	None	High.
0	100	100	90–95	<0. 063	0. 20–0. 22	6. 0–6. 5	None	High.
0	100	95–100	80–95	0. 2–0. 63	0. 18–0. 20	6. 6–8. 4	None	Moderate.
0	100	90–100	85–95	0. 63–2. 0	0. 16–0. 18	6. 6–7. 8	None	Moderate.
0	50–80	20–50	15–25	>6. 3	0. 04–0. 06	7. 4–8. 4	None	Low.
0	100	100	80–95	<0. 063	0. 04–0. 06	7. 4–10. 0	Slight to high	High.
10–20	60–70	50–80	35–65	0. 63–2. 0	0. 12–0. 15	6. 6–9. 0	None	Low.
5–20	50–90	40–80	35–65	2. 0–6. 3	0. 12–0. 15	5. 6–7. 3	None	Low.
0	100	100	5–20	>2. 0	0. 03–0. 05	6. 6–8. 4	None	Low.
0	60–80	50–70	35–50	0. 63–2. 0	0. 15–0. 17	7. 4–8. 4	None	Low.
0	30–60	20–50	10–25	2. 0–6. 3	0. 04–0. 06	7. 4–8. 4	None	Low.
0	100	100	70–80	0. 63–2. 0	0. 10–0. 12	8. 4–9. 6	Slight to severe	Moderate.
0	100	100	75–95	0. 06–0. 20	0. 04–0. 06	8. 5–10. 0	Moderate to severe.	High.
0	80–95	60–90	30–60	0. 63–2. 0	0. 08–0. 12	5. 8–6. 5	None	Low.
15–35	60–90	50–80	30–60	0. 63–2. 0	0. 10–0. 12	5. 6–6. 5	None	Low.
15–35	50–80	20–70	15–35	2. 0–6. 3	0. 08–0. 10	7. 4–8. 4	None	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table[1][2]	Depth to bedrock	Hydrologic group[1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
Ricks: RhA, RhB, RhC	--------	>60	A	0–18	Gravelly loam and gravelly sandy loam.	ML, SM, or GM	A–4 or A–2
				18–60	Very gravelly sand	GM or GP–GM	A–1
Riverwash: Rk. No valid estimates can be made.							
Rock land: RO. No valid estimates can be made.							
Roshe Springs: Rs	0–36 (30–60)	>60	C (B)	0–60	Silt loam	ML	A–4
Rough broken land: Rt. No valid estimates can be made.							
*St. Marys: SAG, SCG For properties of Curtis Creek soil in SCG, refer to the Curtis Creek series.	--------	40–60+	B	0–60	Gravelly fine sandy loam and very cobbly fine sandy loam.	GM	A–2 or A–1
*Salt Lake: Sd, Se, Sf, Sg, Sh. For properties of Logan soil in Sf, of the Roshe Springs soil in Sg, and of the Trenton soil in Sh, refer to their respective series.	0–30 (30–60)	>60	D	0–66	Silty clay	CH	A–7
Scave: SlE, SKE	--------	>60	C	0–16	Silt loam	ML or OL	A–4
				16–34	Cobbly loam	GM or SM	A–4 or A–2
				34–60	Very cobbly clay	GC	A–2
Scout: SLG	--------	>60	B	0–18	Light loam	ML or SM	A–4
				18–62	Very gravelly very fine sandy loam and very gravelly sandy loam.	GM	A–2 or A–4
Shay: Sm	30–50	>60	C	0–30	Silty clay loam and silty clay.	CH or CL	A–7 or A–6
				30–60	Stratified silt loam to sandy loam.	CL or ML	A–6 or A–4
*Sheep Creek: SNG2, SOG2, SPG2, SRG2. For properties of Agassiz soil in SOG2, of Despain soil in SPG2, and of Maughan soil in SRG2, refer to their respective series.	--------	26–40	C	0–28	Very cobbly clay loam and very cobbly loam.	GM	A–4 or A–2
				28	Fractured limestone bedrock.		
*Smarts: SSE, STG2, SUG For properties of Hoskin soil in STG2, and Lucky Star and Poleline soil in SUG, refer to their respective series.	--------	>60	B	0–22	Silt loam or gravelly silt loam.	ML or OL	A–4
				22–60	Very cobbly loam	GM	A–2
Steed: SvA, SvB, SvC	--------	>60	A	0–17	Gravelly loam and very gravelly sandy loam.	ML or GM	A–4 or A–2
				17–60	Very gravelly loamy sand.	GM	A–1 or A–2

See footnotes at end of table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve— No. 4 (4.7 mm.)	Percentage passing sieve— No. 10 (2.0 mm.)	Percentage passing sieve— No. 200 (0.074 mm.)	Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
				Inches per hour	*Inches per inch of soil depth*	*pH*		
0	35–90	30–85	20–65	2. 0–6. 3	0. 12–0. 14	6. 6–7. 8	None	Low.
0–10	25–35	20–30	5–25	>2. 0	0. 03–0. 05	7. 8–8. 4	None	Low.
0	100	100	70–90	0. 63–2. 0	0. 16–0. 18	8. 4–9. 0	None to slight	Low to moderate.
15–35	30–60	20–50	10–35	2. 0–6. 3	0. 06–0. 10	6. 1–7. 8	None	Low.
0	100	100	90–100	<0. 2	0. 18–0. 20	7. 4–9. 0	None to slight	High.
0	90–100	80–95	65–85	0. 63–2. 0	0. 22–0. 25	5. 6–6. 5	None	Low.
10–35	60–80	30–70	25–50	0. 63–2. 0	0. 08–0. 11	5. 6–6. 5	None	Low.
25–40	35–50	20–40	15–30	0. 06–0. 20	0. 08–0. 10	5. 6–6. 5	None	Moderate.
0	75–100	60–95	30–70	2. 0–6. 3	0. 13–0. 17	5. 1–7. 3	None	Low.
0–10	30–70	35–50	15–45	2. 0–6. 3	0. 06–0. 10	5. 1–6. 5	None	Low.
0	100	100	85–100	0. 063–0. 20	0. 16–0. 18	6. 6–8. 4	None to slight	Moderate to high.
0	100	100	50–90	0. 063–2. 0	0. 16–0. 18	7. 4–9. 0	None to slight	Moderate.
10–40	35–75	20–60	15–50	0. 63–2. 0	0. 08–0. 12	6. 6–8. 4	None	Low.
0–10	75–100	60–90	50–75	0. 63–2. 0	0. 14–0. 18	6. 1–7. 0	None	Low.
15–35	30–70	15–50	15–35	0. 63–2. 0	0. 10–0. 13	6. 1–7. 3	None	Low.
0–15	30–90	45–80	30–65	2. 0–6. 30	0. 10–0. 15	7. 4–7. 8	None	Low.
0–15	50–70	20–50	10–25	>2. 0	0. 04–0. 06	7. 4–7. 8	None	Low.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal water table [1] [2]	Depth to bedrock	Hydrologic group [1]	Depth from surface (representative profile)	Classification		
					USDA texture	Unified	AASHO
	Inches	*Inches*		*Inches*			
Sterling: SwC, SwD, SwF2	--------	>60	A	0–16	Gravelly loam	GM or SM	A-4 or A-2
				16–60	Very gravelly sandy loam and very gravelly loamy sand.	GP-GM or GM	A-1
Stony alluvial land: Sy. No valid estimates can be made.							
Timpanogos: TmA, TmB, TmC, TmD2, TnA.	[4] 36–54	>60	B	0–60	Loam	ML	A-4
Trenton: TrA, TrB, TrC, TrD2, TtA	[5] 40–60	>60	C	0–60	Silty clay	CH	A-7
*Wheelon: WhE, WhF2, WlE2 For properties of Collinston soil in WlE2, refer to the Collinston series.	--------	24–>60	C	0–66	Silt loam and silty clay loam.	ML	A-4
*Winn: Wn, Wp For properties of Provo soil in Wp, refer to the Provo series.	30–50	>60	C (B)	0–60	Loam and stratified silt loam.	ML	A-4
Woods Cross: Wr	10–30	>60	D	0–36	Heavy clay loam	OL or CH	A-7
				36–60	Stratified loam	CL or ML	A-6 or A-4
Yeates Hollow: YHE, YHG, YLE2	--------	40–>60	C	0–11	Extremely stony silt loam.	SM or ML	A-4
				11–46	Very cobbly clay loam and very cobbly clay. Fractured quartzite and sandstone rock.	GC	A-2

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[1] Values or letter symbols enclosed by parentheses refer to conditions where the soil has been drained.

[2] Dashes in this column mean that there was no water table within the depth of observation, which is 5 feet unless limited by bedrock.

[3] Seasonal water table.

significant to engineering—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water capacity	Reaction (paste)	Salinity	Shrink-swell potential
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)					
				Inches per hour	*Inches per inch of soil depth*	*pH*		
0–15	50–90	40–70	25–50	2. 0–6. 3	0. 10–0. 12	7. 4–8. 9	None	Low.
0–15	30–50	10–50	5–25	0. 63–2. 0	0. 04–0. 06	7. 9–9. 0	None	Low.
0	100	90–100	60–80	0. 63–2. 0	0. 16–0. 18	6. 6–8. 4	None	Moderate.
0	100	100	85–100	0. 06–0. 2	0. 14–0. 17	7. 4–9. 6	Slight to severe	High.
0	100	90–100	85–95	0. 20–0. 63	0. 08–0. 12	7. 4–9. 0	None	Moderate.
0	90–100	75–100	50–70	0. 63–6. 3	0. 16–0. 18	7. 4–8. 9	None	Moderate.
0	100	100	70–90	0. 06–0. 20	0. 16–0. 19	6. 6–7. 8	None	High.
0	100	70–100	50–90	0. 2–2. 0	0. 14–0. 18	7. 4–8. 4	None	Moderate.
5–10	60–90	50–85	35–65	0. 63–2. 0	0. 10–0. 12	6. 1–7. 3	None	Low.
15–40	30–60	20–50	15–35	0. 06–0. 20	0. 08–0. 10	5. 6–7. 3	None	Moderate.

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[4] Depth to water table where natural drainage is moderately good. Where natural drainage is good, there is no water table within the depth of observations.

[5] Depth to water table where natural drainage is moderately good. Where natural drainage is somewhat poor, the depth to water table is 20 to 40 inches.

TABLE 4.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of at least two or more kinds of soil, which series in the first

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Agassiz: AAE, AAG2, ABG2, ADG2, AEG2, AGE, AGG2. For interpretations of Bradshaw soil in ABG2, of Dateman soil in ADG2 of Elwood soil in AEG2, and of Goring soil in AGE and AGG2, refer to their respective series.	Poor: very cobbly.	Not suitable: very cobbly; poorly graded; excessive fines.	Good to fair: A-2 or A-4 material.	Bedrock at a depth of 10 to 20 inches; slopes of 6 to 70 percent; very cobbly.	Bedrock at a depth of 10 to 20 inches; slopes of 6 to 70 percent.	Medium shear strength; susceptible to piping; semipervious; very cobbly; bedrock at a depth of 10 to 20 inches; low to medium compressibility.
*Airport: AhA, Ak, Am For interpretations of Salt Lake soil in Am, refer to the Salt Lake series.	Poor: alkali; salts.	Not suitable: excessive fines.	Fair to poor: A-4 and A-6 material.	Poor embankment material; high water table; high frost-heave potential.	High water table; slopes of 0 to 3 percent.	Low to medium shear strength; semipervious to impervious.
*Ant Flat: AND, AOE2 For interpretations of Despain soil in AOE2, refer to the Despain series.	Fair in upper 12 inches.	Not suitable: excessive fines.	Poor: dominantly A-4, A-6, and A-7 material.	Poor embankment material; slopes of 6 to 30 percent; high plasticity; high organic-matter content in upper 7 inches.	Slopes of 6 to 30 percent.	Low shear strength; impervious; high compressibility.
*Avon: ArA, ArB, ArC, ArD, AsC, AsE. For interpretations of Collinston soil in AsC and AsE, refer to the Collinston series.	Fair in upper 12 inches: silty clay loam.	Not suitable: excessive fines.	Fair to poor: A-4 and A-6 material.	Fair embankment material; moderate frost-heave potential; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Medium to low shear strength; semipervious to impervious; medium compressibility; subject to piping.
*Barfuss: BAF For interpretations of Leatham soil, refer to the Leatham series.	Good in upper 10 inches.	Not suitable: excessive fines.	Fair to poor: A-4 and A-6 material.	Fair embankment material; moderate frost-heave potential; slopes of 10 to 50 percent; high organic-matter content in upper 8 inches.	Slopes of 10 to 50 percent.	Susceptible to piping; semipervious to impervious; medium to low shear strength.
Battle Creek: BcA, BcD	Poor in upper 12 inches: silty clay.	Not suitable: excessive fines.	Poor: A-7 material.	Poor embankment material; high plasticity; high shrink-swell potential; slopes of 0 to 20 percent.	Soil features favorable; slopes of 0 to 20 percent.	Low to medium shear strength.

interpretations of soils

may have different properties and limitations. For this reason the reader should follow carefully the instructions for referring to other column of this table]

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 6 to 70 percent.	Severe: bedrock at a depth of 10 to 20 inches; slopes of 6 to 70 percent.	Severe: bedrock at a depth of 10 to 20 inches; slopes of 6 to 70 percent.
Slow and very slow permeability; high water table.	High water table; slight to severe salinity, affected by alkali.	Not applicable	Not applicable	Severe: water table at a depth of 0 to 40 inches; somewhat poorly and poorly drained.	Severe: slow and very slow permeability; water table at a depth of 0 to 40 inches.	Moderate: moderate shrink-swell potential; high water table.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 6 to 30 percent; high shrink-swell potential.	Severe: slow permeability; fine texture; slopes of 6 to 30 percent.	Severe: slopes of 6 to 30 percent.
Not applicable	Slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Severe: high shrink-swell potential.	Severe: moderately slow permeability; slopes of 0 to 20 percent.	Slight to severe: high shrink-swell potential; slopes of 0 to 20 percent.
Not applicable	Slopes of 0 to 50 percent; moderately slow permeability.	Slopes of 0 to 50 percent; moderately slow permeability.	Slopes of 0 to 50 percent.	Moderate to severe: slopes of 0 to 50 percent; moderate shrink-swell potential.	Severe: slopes of 0 to 50 percent; moderately slow permeability.	Severe: slopes of 0 to 50 percent.
Not applicable	Moderately slow intake rate; slopes of 0 to 20 percent.	Slow permeability; fine-textured subsoil; slopes of 0 to 20 percent.	Fine textured; subject to cracking; slopes of 0 to 20 percent.	Severe: high shrink-swell potential.	Severe: slow permeability; slopes of 0 to 20 percent.	Slight to severe: slopes of 0 to 20 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Bickmore: BGG, BKG2, BLG2. For interpretations of Agassiz soil in BKG2, and of Sheep Creek soil in BLG2, refer to their respective series.	Fair to a depth of 16 inches: gravelly silt loam.	Poor: very cobbly; excessive fines.	Good to fair: A–2 and A–4 material.	Bedrock at a depth of 28 to 40 inches; slopes of 30 to 70 percent; very cobbly.	Semipervious to pervious surface; bedrock at a depth of 28 to 40 inches; slopes of 30 to 70 percent.	Medium shear strength; susceptible to piping; semipervious; cobbly; low to medium compressibility.
Blackrock: BmB, BmC, BmD, BnD.	Fair to a depth of 39 inches: gravelly loam.	Poor to not suitable: 35 to 55 percent fines.	Fair: A–4 material.	Moderate frost-heave potential; slopes of 3 to 20 percent.	Slopes of 3 to 20 percent.	Susceptible to piping; low to medium shear strength; low to medium compressibility; semipervious.
*Bradshaw: BSG2 For interpretations of Agassiz soil, refer to the Agassiz series.	Good to a depth of 14 inches.	Fair below a depth of 14 inches: 25 to 50 percent fines.	Good to fair: A–2 and A–4 material.	Slopes of 30 to 60 percent; cobbly and very cobbly.	Slopes of 30 to 60 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
Cache: Ca	Poor: silty clay; salts; poorly drained.	Not suitable: excessive fines.	Poor: A–7 material; high water table.	Very poor embankment material; high water table; moderate frost-heave potential; subject to overflow; high plasticity.	High water table; slopes of 0 to 1 percent.	Low shear strength; high compressibility.
Cardon: Cd	Poor: silty clay.	Not suitable: excessive fines.	Poor: A–7 material.	Very poor embankment material; high water table; moderate frost-heave potential; high plasticity.	High water table; slopes of 0 to 3 percent.	Low shear strength; impervious; high compressibility.
Center Creek: CE	Good to a depth of 8 inches.	Not suitable: excessive fines.	Poor: A–6 and A–7 material.	Poor embankment material; seasonal high water table; medium plasticity.	Seasonal high water table; slopes of 1 to 3 percent.	Low to medium shear strength; semipervious; high organic-matter content in surface layer; medium compressibility; susceptible to piping.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent; bedrock at a depth of 28 to 40 inches.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 28 to 40 inches.	Severe: slopes of 30 to 70 percent; very cobbly; bedrock at a depth of 28 to 40 inches.
Not applicable	Slopes of 3 to 20 percent; moderate intake rate.	Gravelly textured; some cobblestones; slopes of 3 to 20 percent.	Gravelly textured; some cobblestones; slopes of 3 to 20 percent.	Slight to severe: slopes of 3 to 20 percent.	Slight to severe: moderate permeability; slopes of 3 to 20 percent.	Moderate to severe: moderate permeability; slopes of 3 to 20 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.
Very slow permeability; surface ponding; subject to overflow; high water table; gravity outlets difficult to obtain; silty clay.	Low available water capacity; salts; very slow intake rate; subject to overflow; high water table.	Not applicable	Not applicable	Severe: high shrink-swell potential; water table at a depth of 0 to 20 inches; poorly drained.	Severe: very slow permeability; water table at a depth of 0 to 20 inches.	Severe: high shrink-swell potential; water table at a depth of 0 to 20 inches.
Very slow permeability; high water table; silty clay.	Slow intake rate; high water table; very slow permeability.	Not applicable	Not applicable	Severe: high shrink-swell potential; somewhat poorly drained; water table at a depth of 30 to 60 inches.	Severe: very slow permeability; high water table.	Moderate: high shrink-swell potential; water table at a depth of 30 to 60 inches.
Moderately slow permeability; seasonal high water table; stratified substratum; outlets are very difficult to obtain.	Moderately slow intake rate; seasonal high water table.	Seasonal high water table; moderately slow permeability.	Seasonal high water table.	Severe: seasonal high water table at a depth of 20 to 40 inches; somewhat poorly drained.	Severe: seasonal high water table at a depth of 20 to 40 inches; moderately slow permeability.	Moderate: moderately slow permeability; seasonal high water table.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
					Farm ponds	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area	Embankment
Clegg: CFE	Good to a depth of 20 inches.	Not suitable to a depth of 20 inches; poor below a depth of 20 inches: poorly graded; excessive fines; very cobbly.	Good to fair: A-2 and A-4 material.	Substratum very cobbly; slopes of 20 to 30 percent.	Slopes of 20 to 30 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
*Cluff: CGE, CHE, CIE For interpretations of Lucky Star soil in CHE, and of the Scout soil in CIE, refer to their respective series.	Good to a depth of 10 inches; poor below a depth of 10 inches: very gravelly.	Poor: poorly graded; excessive fines; some cobblestones.	Good: dominantly A-2 material.	Slopes of 6 to 30 percent.	Slopes of 6 to 30 percent.	Medium to high shear strength; semipervious to impervious; low compressibility.
Collett: Ck	Fair to a depth of 12 inches, except for water table.	Not suitable: excessive fines.	Poor; A-6 and A-7 material.	Poor embankment material; high water table; moderate frost-heave potential; medium plasticity.	High water table; slopes of 0 to 3 percent.	Low to medium shear strength; impervious; medium compressibility.
Collinston: ClA, CmC, CmD, CmE2.	Good to a depth of 15 inches.	Not suitable: excessive fines.	Fair: A-4 material.	Moderate frost-heave potential; moderately erodible in cuts and fills; strongly undulating topography; slopes of as much as 30 percent.	Semipervious; subject to piping; slopes of as much as 30 percent.	Low to medium shear strength; susceptible to piping; semipervious.
Crookston: CoA, CoB, CoC	Good	Not suitable: excessive fines.	Fair: A-4 material.	Moderate frost-heave potential; slopes of 0 to 10 percent.	Semipervious; subject to piping.	Low to medium shear strength; susceptible to piping; semipervious; medium compressibility.
Crowshaw: CrB, CrC, CrD	Fair: gravelly loam.	Poor to not suitable: 35 to 55 percent fines.	Fair: A-4 material.	Low to moderate frost-heave potential; slopes of 3 to 20 percent.	Slopes of 3 to 20 percent.	Low to medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
*Curtis Creek: CSE, CSG For interpretations of Goring soil, refer to the Goring series.	Good to a depth of 12 inches.	Not suitable: excessive fines.	Fair: A-4 material.	Bedrock at a depth of 13 to 20 inches; slopes of 10 to 60 percent.	Bedrock at a depth of 13 to 20 inches; slopes of 10 to 60 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 20 to 30 percent.	Severe: slopes of 20 to 30 percent.	Severe: slopes of 20 to 30 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 6 to 30 percent.	Moderate to severe: slopes of 6 to 30 percent.	Severe: very gravelly; slopes of 6 to 30 percent.
Slow permeability; high water table.	Slow intake rate; high water table.	Not applicable	Not applicable	Severe: water table at a depth of 20 to 36 inches; high shrink-swell potential; somewhat poorly drained.	Severe: water table at a depth of 20 to 36 inches; slow permeability.	Moderate: high organic-matter content; water table at a depth of 20 to 30 inches.
Not applicable	Moderate intake rate; slopes of 6 to more than 20 percent; generally not suitable for irrigation.	Slopes of 1 to 30 percent.	Slopes of 1 to 30 percent.	Slight to severe: slopes of 1 to 30 percent.	Moderate to severe: slopes of 1 to 30 percent; moderate permeability.	Moderate to severe: slopes of 1 to 30 percent; moderate permeability.
Not applicable	Moderate intake rate; slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent.	Moderate to severe: moderate permeability; slopes of 0 to 10 percent.	Moderate to severe: slopes of 0 to 10 percent; moderate permeability.
Not applicable	Moderate intake rate; slopes of 3 to 20 percent.	Slopes of 3 to 20 percent.	Slopes of 3 to 20 percent.	Slight to severe: slopes of 3 to 20 percent.	Moderate to severe: slopes of 3 to 20 percent.	Moderate to severe: slopes of 3 to 20 percent; moderate permeability.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to very severe: slopes of 10 to 60 percent; bedrock at a depth of 13 to 20 inches.	Severe: bedrock at a depth of 13 to 20 inches; slopes of 10 to 60 percent.	Severe: bedrock at a depth of 13 to 20 inches; slopes of 10 to 60 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Dagor: DaC, DaD	Good to a depth of 34 inches.	Not suitable: excessive fines.	Fair: A-4 material.	Moderate frost-heave potential; poor embankment material; slopes of 4 to 20 percent; high organic-matter content in upper 24 inches.	Slopes of 4 to 20 percent.	Low to medium shear strength; susceptible to piping; semipervious; medium compressibility.
*Dateman: DEG, DHG For interpretations of Bradshaw soil in DHG, refer to the Bradshaw series.	Poor: cobbly.	Poor: cobbly.	Good to fair: A-2 and A-4 material.	Bedrock at a depth of 26 to 40 inches; slopes of 40 to 70 percent; cobbly.	Semipervious to pervious surface layer; bedrock at a depth of 27 to 40 inches.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
*Datwyler: DLG, DNG For interpretations of Elzinga and Maughan soils in DNG, refer to their respective series.	Poor: cobbly.	Poor: cobbly; clayey fines.	Good to poor: A-2 and A-6 material.	Bedrock at a depth of 32 to 40 inches; slopes of 30 to 60 percent; cobbly; fines are plastic.	Bedrock at a depth of 32 to 40 inches; slopes of 30 to 60 percent.	Medium to high shear strength; impervious; low compressibility.
*Despain: DPG, DSG For interpretations of Bickmore soil in DPG, and of Lucky Star soil in DSG, refer to their respective series.	Fair to a depth of 16 inches: gravelly; some cobblestones.	Poor to not suitable: 25 to 60 percent fines.	Fair to good: A-2 and A-4 material.	Slopes of 20 to 70 percent; some cobblestones.	Slopes of 20 to 70 percent.	Medium shear strength; semipervious; low to medium compressibility.
*Elwood: EDG, EGE, EME, EMG. For interpretations of Agassiz soil in EGE, and of Mult soil in EME and EMG, refer to their respective series.	Good to a depth of 11 inches.	Poor to not suitable: 25 to 60 percent fines.	Good to fair: A-2 and A-4 material.	Bedrock at a depth of 20 to 40 inches; slopes of 10 to 60 percent; cobbly.	Bedrock at a depth of 20 to 40 inches; slopes of 10 to 60 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
*Elzinga Mapped only with soils of the Datwyler and Hoskin series.	Good to a depth of 22 inches.	Not suitable: cobbly; excessive fines.	Good to fair: A-4 and A-2 material.	Bedrock at a depth of 60 inches or more; slopes of 10 to 60 percent; cobbly.	Slopes of 10 to 60 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
Fitzgerald: FGD	Poor: very gravelly; cobbly and stony.	Poor: stony and cobbly; poorly graded.	Good to fair: A-2 and A-4 material.	Cobbly and stony; slopes of 10 to 20 percent.	Slopes of 10 to 20 percent.	Medium to high shear strength; susceptible to piping; semipervious; low compressibility.
Flygare: FLD	Good in some areas to a depth of 27 inches; poor in some areas: cobbly.	Poor to not suitable: excessive fines; cobbly.	Good to fair: A-4 and A-2 material.	Cobbly; slopes of 3 to 20 percent; high organic-matter content in upper 27 inches.	Slopes of 3 to 20 percent.	Medium shear strength; susceptible to piping; semipervious; low to medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Moderate intake rate; slopes of 4 to 20 percent.	Slopes of 4 to 20 percent.	Slopes of 4 to 20 percent.	Slight to severe: slopes of 4 to 20 percent.	Moderate to severe: slopes of 4 to 20 percent.	Moderate to severe: slopes of 4 to 20 percent; moderate permeability.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 40 to 70 percent.	Severe: slopes of 40 to 70 percent.	Severe: slopes of 40 to 70 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 20 to 70 percent.	Severe: slopes of 20 to 70 percent.	Severe: slopes of 20 to 70 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: bedrock at a depth of 20 to 40 inches; slopes of 10 to 60 percent.	Severe: slopes of 10 to 60 percent; bedrock at a depth of 20 to 40 inches.	Severe: slopes of 10 to 60 percent; bedrock at a depth of 20 to 40 inches.
Not applicable	Not applicable	Slopes of 10 to 60 percent.	Slopes of 10 to 60 percent.	Moderate to severe: slopes of 10 to 60 percent.	Severe: slopes of 10 to 60 percent.	Severe: slopes of 10 to 60 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate: slopes of 10 to 20 percent.	Severe: slopes of 10 to 20 percent.	Severe: slopes of 10 to 20 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Slight to severe: slopes of 3 to 20 percent.	Slight to severe: slopes of 3 to 20 percent.	Moderate to severe: slopes of 3 to 20 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Foxol: FOG	Poor: gravelly; cobbly.	Poor: 20 to 50 percent fines.	Fair to good: A–2 and A–4 material.	Bedrock at a depth of 14 to 20 inches; slopes of 30 to 60 percent; some cobblestones.	Bedrock at a depth of 14 to 20 inches; slopes of 30 to 60 percent.	Medium to high shear strength; susceptible to piping; semipervious; low compressibility.
*Goring: GGE, GOE2 For interpretations of Obray soil in GOE2, refer to the Obray series.	Good to a depth of 7 inches; not suitable below a depth of 7 inches.	Not suitable: excessive fines.	Poor: A–7 material.	Poor embankment material; slopes of 3 to 60 percent; high plasticity.	Slopes of 3 to 60 percent.	Low shear strength; high compressibility; impervious.
Gravel pit: Gp. Onsite investigation required.						
Green Canyon: GrA, GrB	Fair to a depth of 16 inches; not suitable below a depth of 16 inches: gravelly.	Poor below a depth of 16 inches: 10 to 25 percent fines.	Fair to good: A–1 and A–4 material.	Slopes of 0 to 7 percent.	Slopes of 0 to to 7 percent.	Medium to high shear strength; susceptible to piping; low compressibility; semipervious to pervious.
Greenson: GsA, GsB, GsC, GuA, GvA.	Good	Not suitable: excessive fines.	Fair: A–4 material.	Fair to poor embankment material; high water table; high frost-heave potential; slightly undulating topography.	High water table; slopes of 0 to 10 percent.	Low to medium shear strength; susceptible to piping; semipervious; medium compressibility.
Hendricks: HdA, HdB, HdC, HdD.	Good to a depth of 15 inches; fair below a depth of 15 inches.	Not suitable: excessive fines.	Fair to poor: A–4 and A–6 material.	Fair embankment material; high frost-heave potential; slopes of 1 to 20 percent; medium plasticity.	Slopes of 1 to 20 percent.	Impervious to semipervious; low to medium shear strength; medium compressibility.
Hiibner: HeC, HeD, HeE, HfE.	Poor: extemely stony and gravelly.	Not suitable: extremely stony and cobbly.	Poor: extremely stony and cobbly; mostly A–6 material.	Some cobblestones and stones; poor embankment material; slopes of 1 to 30 percent; high plasticity.	Slopes of 1 to 30 percent.	Medium to high shear strength; low compressibility.
*Hillfield: HgE2, HhE2 For interpretations of Timpanogos soil in HhE2, refer to the Timpanogos series.	Good	Not suitable: excessive fines.	Fair: A–4 material.	High frost-heave potential; eroded on steeper slopes; slopes of 10 to 30 percent.	Slopes of 10 to 30 percent.	Susceptible to piping; semipervious; low to medium shear strength; low to medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 60 percent; bedrock at a depth of 14 to 20 inches.	Severe: slopes of 30 to 60 percent; bedrock at a depth of 14 to 20 inches.	Severe: slopes of 30 to 60 percent; bedrock at a depth of 14 to 20 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: high shrink-swell potential; slopes of 3 to 60 percent.	Severe: slopes of 3 to 60 percent; slow permeability.	Moderate to severe: slopes of 3 to 60 percent.
Not applicable	Moderate intake rate; low available water capacity; very gravelly below a depth of 16 inches.	Gravelly; moderate to rapid permeability.	Low available water capacity; very gravelly below a depth of 16 inches.	Slight	Slight	Severe: rapid permeability.
Moderate permeability; high water table.	Moderate intake rate; slopes of 0 to 10 percent.	High water table in some areas.	Slopes of 0 to 10 percent.	Moderate: water table at a depth of 30 to 40 inches; moderate shrink-swell potential.	Severe: water table at a depth of 30 to 40 inches.	Moderate: moderate permeability; water table at a depth of 30 to 40 inches.
Not applicable	Moderate intake rate; slopes of 1 to 20 percent.	Slopes of 1 to 20 percent.	Slopes of 1 to 20 percent.	Moderate to severe: slopes of 1 to 20 percent; moderate shrink-swell potential.	Moderate to severe: slopes of 1 to 20 percent; moderate permeability.	Moderate to severe: slopes of 1 to 20 percent; moderate permeability.
Not applicable	Moderately slow to slow intake rate; slopes of 1 to 30 percent.	Slow permeability; fine texture; cobblestones and stones; slopes of 1 to 30 percent.	Fine textured; cobblestones and stones; slopes of 1 to 30 percent.	Moderate to severe: moderate shrink-swell potential; slopes of 1 to 30 percent.	Severe: slow permeability; slopes of 1 to 30 percent.	Severe: high in stone fragments; slopes of 1 to 30 percent.
Not applicable	Moderate intake rate; slopes of 10 to 30 percent.	Slopes of 10 to 30 percent.	Slopes of 10 to 30 percent.	Moderate to severe: slopes of 10 to 30 percent.	Severe: slopes of 10 to 30 percent.	Severe: slopes of 10 to 30 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Hoskin: HIB, HKG2, HLG2, HMG2, HNG, HOG2, HSG2. For interpretations of Datwyler soil in HGL2, of Elzinga soil in HMG2, of Scave soil in HNG, of Scout soil in HOG2, and of Smarts soil in HSG2, refer to their respective series.	Poor: gravelly; cobbly.	Poor: very cobbly; 15 to 40 percent fines.	Good to fair: A–2 and A–4 material.	Bedrock at a depth of 24 to 40 inches; slopes of 30 to 70 percent; very cobbly.	Bedrock at a depth of 24 to 40 inches; slopes of 30 to 70 percent.	Medium to high shear strength; susceptible to piping; pervious to semipervious.
Hyrum: HuC, HuE, HyC	Fair to a depth of 18 inches: gravelly; cobblestones; poor below a depth of 18 inches.	Fair to poor below a depth of 18 inches: 20 to 35 percent fines; very cobbly.	Fair to good: A–1, A–2, and A–4 material.	Very cobbly; slopes of 4 to 25 percent.	Slopes of 4 to 25 percent.	Pervious to semipervious; medium to high shear strength; low compressibility.
*Jordon: Jo, Jr For interpretations of Lasil soil in Jr, refer to the Lasil series.	Poor: salts; silty clay.	Not suitable: excessive fines.	Poor: A–7 material.	Very poor embankment material; seasonal high water table; moderate frost-heave potential; high plasticity.	Seasonal high water table; slopes of 0 to 1 percent.	High compressibility; low shear strength; impervious.
Kidman: KdA, KdD, KfA, KfB, KfC.	Good	Fair to not suited: 15 to 50 percent fines.	Fair to good: A–4, A–2, and A–1 material.	Water table at a depth of 40 inches to more than 60 inches; moderate frost-heave potential.	Fluctuating high water table.	Susceptible to piping; pervious to semipervious; medium shear strength; low compressibility.
*Kirkham: Ks, Kt For interpretations of Shay soil, refer to the Shay series.	Good to a depth of 9 inches; fair to a depth of 23 inches.	Not suitable: excessive fines.	Fair to poor: A–4 and A–7 material.	Seasonal high water table; high frost-heave potential; subject to flooding.	Seasonal high water table; slopes of 0 to 1 percent.	Impervious to semipervious; low to medium shear strength; medium compressibility.
Lakewin: La	Poor: gravelly coarse sandy loam.	Fair to good below a depth of 18 inches: 10 to 30 percent fines.	Good: A–1 and A–2 material.	Good embankment material.	Slopes of 0 to 3 percent.	Pervious; high shear strength; low compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 24 to 40 inches.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 24 to 40 inches.
Not applicable	Moderately rapid intake rate; slopes of 4 to 25 percent.	Very cobbly; moderate permeability; slopes of 4 to 25 percent.	Cobbly; slopes of 4 to 25 percent.	Moderate to severe: slopes of 4 to 25 percent.	Moderate to severe: slopes of 4 to 25 percent; moderate permeability.	Severe: slopes of 4 to 25 percent; moderate permeability.
Slow permeability; seasonal high water table.	Slow intake rate; seasonal high water table; salt and alkali.	Not applicable	Not applicable	Severe: water table at a depth of 30 to 48 inches; high shrink-swell potential; somewhat poorly drained.	Severe: slow permeability; water table at a depth of 30 to 48 inches.	Moderate: water table at a depth of 30 to 48 inches.
Moderate permeability; water table at a depth of 40 inches to more than 60 inches; ditchbanks are unstable and slough rapidly.	Moderately rapid intake rate; water table at a depth of 40 inches to more than 60 inches; slopes of 0 to 15 percent.	Slopes of 0 to 15 percent.	Slopes of 0 to 15 percent.	Slight to moderate: slopes of 0 to 15 percent.	Moderate to severe: slopes of 0 to 15 percent; water table at a depth of 40 inches to more than 60 inches.	Severe: slopes of 0 to 15 percent; moderately rapid permeability.
Moderately slow permeability; seasonal high water table; subject to flooding; gravity outlets difficult to obtain; stratified substratum in places.	Moderately slow intake rate; seasonal high water table; subject to flooding.	Not applicable	Not applicable	Severe: seasonal high water table at a depth of 30 to 50 inches; somewhat poorly drained.	Severe: moderately slow permeability; water table at a depth of 30 to 50 inches.	Moderate: seasonal high water table at a depth of 30 to 50 inches.
Not applicable	Rapid intake rate; low available water capacity; best suited to sprinkler irrigation.	Rapid permeability; sandy.	Low available water capacity; sandy.	Slight	Slight: may contaminate ground water.	Severe: rapid permeability.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*LaPlatta: LCG, LGE For interpretations of Obray soil in LGE; refer to the Obray series.	Fair to a depth of 8 inches: silty clay loam.	Not suitable: excessive fines.	Poor: A-6 and A-7 material.	Poor embankment material; slopes of 10 to 50 percent; high plasticity; high content of organic matter in upper 8 inches.	Slopes of 10 to 50 percent.	Impervious; medium to high compressibility; low to medium shear strength.
*Lasil Mapped only with soils of the Jordan series.	Fair to a depth of 12 inches; poor below a depth of 12 inches: severe salinity; strongly alkali.	Not suitable	Poor: high water table; fair shear strength; medium compressibility; fair compaction.	Poor embankment material; high water table; fair bearing capacity; high frost-heave potential; high plasticity.	High water table; slopes of 0 to 3 percent.	Impervious; low shear strength; high compressibility.
Layton: Lh	Fair to a depth of 40 inches.	Fair to good: 10 to 25 percent fines.	Good: A-2 material.	Water table at a depth of 40 to 60 inches.	Slopes of 0 to 1 percent.	Medium shear strength; susceptible to piping; pervious; low compressibility.
*Leatham: LMG2 For interpretations of Barfuss soil, refer to the Barfuss series.	Good	Not suitable: excessive fines.	Fair to poor: A-4 and A-6 material.	Fair embankment material; high frost-heave potential; slopes of 30 to 50 percent.	Slopes of 30 to 50 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.
Lewiston: Ln, Lo	Fair to a depth of 12 inches; poor below a depth of 12 inches: strongly alkali.	Fair to not suitable: 15 to 60 percent fines; no gravel.	Fair to good: A-2 and A-4 material.	High water table; slopes of 0 to 3 percent.	High water table; slopes of 0 to 3 percent.	Low to medium shear strength; susceptible to piping; pervious to semipervious; low to medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Slopes of 10 to 50 percent; moderate to moderately slow intake rate.	Slopes of 10 to 50 percent.	Slopes of 10 to 50 percent.	Severe: high shrink-swell potential; slopes of 10 to 50 percent.	Severe: moderately slow permeability; slopes of 10 to 50 percent.	Severe: slopes of 10 to 50 percent.
Slow to moderately slow permeability; high water table.	Moderately slow intake rate; moderate to severe salinity; high water table; reclamation and drainage needed.	Not applicable	Not applicable	Severe: water table at a depth of 32 to 40 inches; high shrink-swell potential; somewhat poorly drained.	Severe: water table at a depth of 32 to 40 inches; slow permeability.	Moderate: moderately fine texture.
Rapid permeability; water table at a depth of 40 to 60 inches; ditchbanks and trenches are unstable and slough readily.	Rapid intake rate; moderate available water capacity; water table at a depth of 40 to 60 inches.	Not applicable	Not applicable	Moderate: water table at a depth of 40 to 60 inches.	Moderate: water table at a depth of 40 to 60 inches.	Severe: rapid permeability.
Not applicable	Slopes of 30 to 50 percent.	Slopes of 30 to 50 percent.	Slopes of 30 to 50 percent.	Severe: slopes of 30 to 50 percent.	Severe: slopes of 30 to 50 percent.	Severe: slopes of 30 to 50 percent.
Moderately rapid permeability; fluctuating water table; ditchbanks and trenches are generally unstable and slough readily; gravity outlets are difficult to obtain in some areas.	Moderate intake rate; none to moderate salinity; alkali affected; fluctuating water table.	Not applicable	Not applicable	Moderate to severe: water table at a depth of 30 to 40 inches where soil is drained, 10 to 30 inches where soil is undrained; somewhat poorly drained.	Moderate to severe: water table at a depth of 30 to 40 inches where soil is drained, 10 to 30 inches where soil is undrained.	Severe: rapid permeability in substratum.

TABLE 4.—*Engineering*

	Suitability as a source of—			Soil features affecting—		
Soil series and map symbols	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Logan: Lr	Fair to a depth of 13 inches: high water table; high content of organic matter.	Not suitable: excessive fines.	Poor: A–7 material.	High content of organic matter to a depth of 13 inches; very poor embankment material; fluctuating high water table; moderate frost-heave potential; high plasticity.	Fluctuating high water table; slopes of 0 to 3 percent.	Low shear strength; impervious; high compressibility.
*Lucky Star: LSE, LTG, LUE, LVE, LWE, LXE. For interpretations of Goring soil in LUE, of Hoskin soil in LVE, of Red Spur soil in LWE, and of Scout soil in LXE, refer to their respective series.	Fair to a depth of 13 inches; poor at depths between 13 inches and 35 inches: stony and cobbly.	Poor to not suitable: excessive fines; cobbly.	Fair: A–4 material.	Fair embankment material; cobbly; slopes of 6 to 60 percent; high content of organic matter in upper 13 inches.	Slopes of 6 to 60 percent.	Medium to high shear strength; susceptible to piping; semipervious to pervious; low compressibility.
*Maughan: MAG. For interpretations of Datwyler soil, refer to the Datwyler series.	Good to a depth of 25 inches.	Not suitable: excessive fines.	Fair to poor: A–4, A–6, and A–7 material.	Poor embankment material; fines are plastic; cobblestones in substratum; high frost-heave potential; slopes of 30 to 60 percent; high organic-matter content in upper 25 inches.	Slopes of 30 to 60 percent.	Low to medium shear strength; substratum impervious; medium compressibility.
*McMurdie: McA, McB, McC, MdE2. For interpretations of Hillfield soil in MdE2, refer to the Hillfield series.	Fair to a depth of 14 inches; not suitable below a depth of 14 inches.	Not suitable: excessive fines.	Poor: A–6 and A–7 material.	Poor embankment material; high frost-heave potential; slopes of 0 to 20 percent; high plasticity.	Slopes of 0 to 20 percent.	Low shear strength; impervious; high compressibility.
*Mendon: MeA, MeB, MeC, MfB, MfE2. For interpretations of Collinston soil in MfB and MfE2, refer to the Collinston series.	Good to a depth of 9 inches; fair between depths of 9 inches and 24 inches.	Not suitable: excessive fines.	Poor: A–6 material.	Fair embankment material; moderate frost-heave potential; moderately erodible; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Semipervious to impervious; low to medium shear strength; medium compressibility
*Middle. Mapped only with soils of the Richmond series.	Poor: very cobbly.	Poor: very cobbly; 25 to 40 percent fines.	Good to fair: A–2 and A–4 material.	Bedrock at a depth of 24 to 40 inches; slopes of 30 to 70 percent.	Bedrock at a depth of 24 to 40 inches; slopes of 30 to 70 percent.	Medium to high shear strength; semipervious to pervious; low compressibility; susceptible to piping.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Slow permeability; fluctuating water table, ponded in some areas; gravity outlets are difficult to obtain; stratified substratum.	Moderately slow intake rate; fluctuating water table; high content of organic matter in some areas.	Not applicable.	Not applicable.	Severe: water table at a depth of 0 to 40 inches; high shrink-swell potential; poorly and very poorly drained.	Severe: water table at a depth of 0 to 40 inches; slow permeability.	Moderate to severe: high organic-matter content; water table at a depth of 0 to 40 inches.
Not applicable.	Not applicable.	Not applicable.	Not applicable.	Moderate to severe: slopes of 6 to 60 percent.	Moderate to severe: slopes of 6 to 60 percent.	Severe: slopes of 6 to 60 percent.
Not applicable.	Not applicable.	Not applicable.	Not applicable.	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent.
Not applicable.	Moderately slow intake rate; slopes of 0 to 20 percent.	Moderately slow permeability; fine-textured subsoil; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Severe: high shrink-swell potential; slopes of 0 to 20 percent.	Severe: moderately slow permeability; slopes of 0 to 20 percent.	Moderate to severe: slopes of 0 to 20 percent.
Not applicable.	Moderately slow to moderate intake rate; slopes of 0 to 20 percent.	Moderately slow permeability; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Moderate to severe: moderate shrink-swell potential; slopes of 0 to 20 percent.	Severe: moderately slow permeability; slopes of 0 to 20 percent.	Moderate to severe: moderately slow permeability; slopes of 0 to 20 percent.
Not applicable.	Not applicable.	Not applicable.	Not applicable.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 24 to 40 inches.	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.

TABLE 4.—*Engineering*

	Suitability as a source of—			Soil features affecting—		
Soil series and map symbols	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Millville: MIA, MIB	Fair: very strongly calcareous.	Not suitable: excessive fines.	Fair: A-4 material.	Occasional high water table; high frost-heave potential.	High water table in some areas; slopes of 0 to 6 percent.	Low to medium shear strength; susceptible to piping; semipervious; medium compressibility.
Mixed alluvial land: Mm. Onsite investigation required.						
*Mult: MNE, MNG2, MSE. For interpretations of Agassiz soil in MNE and MNG2, and of Lucky Star soil in MSE, refer to their respective series.	Good to a depth of 14 inches; fair below a depth of 14 inches.	Not suitable: excessive fines.	Fair to poor: A-4 and A-6 material.	Bedrock at a depth of 22 to 40 inches; slopes of 6 to 50 percent.	Bedrock at a depth of 22 to 40 inches; slopes of 6 to 50 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.
*Munk: MoG2. For interpretations of Blackrock soil, refer to the Blackrock series.	Fair to poor: very gravelly.	Fair to poor: 10 to 50 percent fines; 20 to 50 percent gravel.	Fair to good: A-1, A-2, and A-4 material.	Partially consolidated below a depth of 20 to 40 inches; slopes of 30 to 70 percent.	Partially consolidated below a depth of 20 to 40 inches; slopes of 30 to 70 percent.	Medium to high shear strength; pervious to semipervious; low compressibility; susceptible to piping.
Nebeker: NbB, NbC, NbE	Good to a depth of 12 inches.	Not suitable: excessive fines.	Poor: A-6 and A-7 material.	Poor embankment material; high frost-heave potential; slopes of 3 to 40 percent; high plasticity.	Slopes of 3 to 40 percent.	Low to medium shear strength; impervious; high to medium compressibility.
Nibley: NcA, NcB	Poor: silty heavy clay loam.	Not suitable: excessive fines.	Poor: A-7 material.	Poor embankment material; moderately high water table; moderate frost-heave potential; high plasticity.	High water table in some areas; slopes of 0 to 6 percent.	Impervious; medium to high compressibility; low to medium shear strength.
Obray: ObB	Poor: silty clay.	Not suitable: excessive fines.	Poor: A-7 material.	Very poor embankment material; moderate frost-heave potential; slopes of as much as 20 percent; high plasticity.	Slopes of as much as 1 to 20 percent.	High compressibility; low shear strength; impervious.
Parleys: PaA, PaB, PaC	Good to a depth of 12 inches; fair between depths of 12 and 30 inches.	Not suitable: excessive fines.	Fair to poor: A-4 and A-6 material.	Fair embankment material; high frost-heave potential; slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Semipervious to impervious; low to medium shear strength; medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Moderate permeability; high water table in some areas.	Moderate intake rate; high water table in some areas.	Slopes of 0 to 6 percent.	Slopes of 0 to 6 percent.	Moderate: some areas have a water table at a depth of 40 to 50 inches.	Moderate: some areas have a water table at a depth of 40 to 50 inches; moderate permeability.	Moderate: moderate permeability.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 6 to 50 percent; bedrock at a depth of 22 to 40 inches.	Severe: slopes of 6 to 50 percent; bedrock at a depth of 22 to 40 inches.	Severe: slopes of 6 to 50 percent; bedrock at a depth of 22 to 40 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.
Not applicable	Moderately slow to moderate intake rate.	Moderately slow permeability; fine-textured subsoil; slopes of 3 to 40 percent.	Fine-textured subsoil; slopes of 3 to 40 percent.	Severe: high shrink-swell potential; slopes of 3 to 40 percent.	Severe: moderately slow permeability; slopes of 3 to 40 percent.	Moderate to severe: slopes of 3 to 40 percent.
Slow permeability; high water table in some areas; fine texture.	Slow intake rate; high water table; fine texture.	Not applicable.	Not applicable	Severe: water table at a depth of 30 to 60 inches; high shrink-swell potential; somewhat poorly drained.	Severe: water table at a depth of 30 to 60 inches; slow permeability.	Moderate: water table at a depth of 30 to 60 inches.
Not applicable	Slopes of 1 to 20 percent; high intake rate if soil is cracked, low intake rate if soil is not cracked; fine texture.	Very slow permeability; fine texture; deep cracks.	Fine texture; deep cracks; slopes of 1 to 20 percent.	Severe: high shrink-swell potential; slopes of 1 to 20 percent.	Severe: very slow permeability.	Slight to severe: slopes of 1 to 20 percent.
Not applicable	Moderate intake rate, slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Moderate: moderate shrink-swell potential; slopes of 0 to 10 percent.	Severe: moderate to slow permeability; slopes of 0 to 10 percent.	Slight to severe: slopes of 0 to 10 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
Parlo: PlA, PlB, PlC	Good to a depth of 11 inches; fair between depths of 11 and 30 inches.	Good to fair below a depth of 20 inches: 15 to 25 percent fines; 50 to 80 percent gravel.	Fair to poor to a depth of 30 inches; good below a depth of 30 inches: A–1 material.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Semipervious to impervious; medium shear stength; medium compressibility.
Payson: Pn	Poor: strongly alkali.	Not suitable: excessive fines.	Poor: A–6 and A–7 material.	Poor embankment material; seasonal high water table; moderate frost-heave potential; high plasticity.	Seasonal high water table; slopes of 0 to 1 percent.	Low shear strength; impervious; high compressibility.
*Picayune: POG2, PRG For interpretations of Agassiz soil in POG2, and of Smarts soil in PRG, refer to their respective series.	Poor: gravelly texture; cobbly.	Poor to not suitable: 35 to 65 percent fines.	Fair: A–4 material.	Slopes of 50 to 80 percent.	Slopes of 50 to 80 percent.	Low to medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
Poleline: PSG2 For interpretations of Agassiz soil, refer to the Agassiz series.	Fair to a depth of 20 inches.	Poor to not suitable: 35 to 65 percent fines; 20 to 40 percent gravel.	Fair: A–4 material.	Slopes of 30 to 70 percent.	Slopes of 30 to 70 percent.	Low to medium shear strength; susceptible to piping; semipervious; low to medium compressibility.
Preston: PtC	Poor: fine sand.	Good to excellent for sand: 5 to 20 percent fines; no gravel.	Good: A–2 or A–3 material.	Slopes of 0 to 10 percent; fine sand.	Slopes of 0 to 10 percent.	Pervious; high shear strength; low compressibility.
Provo: Pu, Pv	Fair to a depth of 12 inches: gravelly loam; not suitable below a depth of 12 inches.	Fair for sand: 10 to 25 percent fines; fair to good for gravel: 50 to 80 percent gravel.	Good: dominantly A–1 material.	Upper 2 inches are peat; high water table; subject to flooding; slopes of 0 to 3 percent.	High water table; slopes of 0 to 3 percent.	Medium to high shear strength; semipervious to pervious; susceptible to piping; low compressibility.
Quinney: Qu	Fair to a depth of 8 inches; poor below a depth of 8 inches: strongly alkali.	Not suitable: excessive fines.	Poor to fair: A–4 and A–6 material.	Poor embankment material; moderately high water table; high frost-heave potential.	High water table; slopes of 0 to 2 percent.	Low to medium shear strength; susceptible to piping; impervious to semipervious.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Moderate intake rate; slopes of 0 to 10 percent; low available water capacity below a depth of 30 inches.	Rapid permeability below a depth of 30 inches; slopes of 1 to 10 percent.	Slopes of 0 to 10 percent; low available water capacity below a depth of 30 inches.	Moderate: moderate shrink-swell potential.	Slight: possible contamination of ground water.	Severe: rapid permeability below a depth of 30 inches.
Very slow permeability; seasonal high water table; gravity outlets difficult to obtain; fine texture.	Slow intake rate; fine texture; seasonal high water table; slight to severe salinity; strongly alkali.	Not applicable	Not applicable	Severe: high shrink-swell potential; somewhat poorly drained; water table at a depth of 30 to 50 inches.	Severe: very slow permeability; water table at a depth of 30 to 50 inches.	Moderate: seasonal high water table at a depth of 30 to 50 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 50 to 80 percent.	Severe: slopes of 50 to 80 percent.	Severe: slopes of 50 to 80 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.	Severe: slopes of 30 to 70 percent.
Not applicable	Rapid intake rate; very low available water capacity.	Generally not suitable; very sandy texture; rapid permeability; erodible.	Generally not suitable; low available water capacity.	Slight to moderate: slopes of 0 to 10 percent.	Slight to moderate: possible contamination of ground water; slopes of 0 to 10 percent.	Severe: rapid permeability; slopes of 0 to 10 percent.
Moderate to moderately rapid permeability; high water table; trenches slough readily.	Moderate intake rate; low available water capacity in substratum; subject to flooding.	Not applicable	Not applicable	Severe: water table at a depth of 26 to 36 inches; poorly drained.	Severe: water table at a depth of 26 to 36 inches.	Severe: moderately rapid permeability below a depth of about 20 inches; water table at a depth of 26 to 36 inches.
Slow permeability; high water table.	Moderate intake rate; high water table; slight to severe salinity; strongly alkali.	Not applicable	Not applicable	Moderate: water table at a depth of 30 to 50 inches; moderate shrink-swell potential.	Severe: slow permeability below a depth of 40 inches; water table at a depth of 30 to 50 inches.	Moderate: water table at a depth of 30 to 50 inches.

TABLE 4.—*Engineering*

	Suitability as a source of—			Soil features affecting—		
Soil series and map symbols	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Red Spur Mapped only with soils of the Lucky Star series.	Good to a depth of 48 inches.	Poor to not suitable: 30 to 60 percent fines.	Fair: dominantly A–4 material.	Fair embankment material; slopes of 10 to 30 percent; high content of organic matter in upper 26 inches.	Slopes of 10 to 30 percent.	Low to medium shear strength; semipervious; susceptible to piping; low to medium compressibility.
*Richmond: RCG2, RDG2, REG2, RFG2, RGG2. For interpretations of Middle soil in RDG2, of Munk soil in REG2, of Nebeker soil in RFG2, and of Sterling soil in RGG2, refer to their respective series.	Poor: very stony and shallow.	Fair: 15 to 35 percent fines; 30 to 80 percent gravel.	Good: A–2 material.	Bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.	Bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.	Medium shear strength; semipervious; low to medium compressibility.
Ricks: RhA, RhB, RhC	Fair to a depth of 18 inches: gravelly loam.	Good to fair below a depth of 18 inches for sand: 5 to 25 percent fines; good for gravel: 70 to 80 percent gravel.	Good below a depth of 18 inches: A–1 material.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Medium to high shear strength; semipervious to pervious; low compressibility.
Riverwash: Rk. Onsite investigation required.						
Rockland: RO. Onsite investigation required.						
Roshe Springs: Rs	Fair to a depth of 8 inches; poor at depths between 8 and 20 inches.	Not suitable: excessive fines.	Fair: A–4 material.	Upper 2 inches are peat; poor embankment material; high water table; high frost-heave potential.	High water table; slopes of 0 to 3 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.
Rough broken land: Rt. Onsite investigation required.						
*St. Marys: SAG, SCG For interpretations of Curtis Creek soil in SCG, refer to the Curtis Creek series.	Fair: gravelly fine sandy loam.	Fair to poor: 10 to 35 percent fines; 50 to 80 percent gravel.	Good: A–1 and A–2 material.	Slopes of 30 to 60 60 percent.	Slopes of 30 to 60 percent.	Pervious to semipervious; medium to high shear strength; low compressibility; susceptible to piping.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 10 to 30 percent; bedrock at a depth of 48 inches to more than 60 inches.	Severe: slopes of 10 to 30 percent; bedrock at a depth of 48 inches to more than 60 inches.	Severe: slopes of 10 to 30 percent; bedrock at a depth of 48 inches to more than 60 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.	Severe: bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.	Severe: bedrock at a depth of 10 to 20 inches; slopes of 30 to 70 percent.
Not applicable	Moderate intake rate; low available water capacity; very gravelly below a depth of 18 inches; slopes of 0 to 10 percent.	Gravelly texture; very rapid permeability below a depth of 18 inches; slopes of 0 to 10 percent.	Gravelly texture; low available water capacity below a depth of 18 inches; slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent; possible ground water contamination.	Severe: very rapid permeability below a depth of 18 inches.
Moderate permeability; high water table except where drained; outlets are difficult to obtain.	Moderate intake rate; high water table in some areas.	Not applicable	Not applicable	Severe: water table at a depth of 0 to 36 inches; poorly drained.	Severe: water table at a depth of 0 to 36 inches.	Severe: high content of organic matter; water table at a depth of 0 to 36 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 60 percent.	Severe: slopes of 30 to 60 percent; bedrock at a depth of 40 inches to more than 60 inches.	Severe: slopes of 30 to 60 percent; bedrock at a depth of 40 inches to more than 60 inches

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Salt Lake: Sd, Se, Sf, Sg, Sh. For interpretations of Logan soil in Sf, of Roshe Springs soil in Sg, and of Trenton soil in Sh, refer to their respective series.	Poor: silty clay.	Not suitable: excessive fines.	Poor: A-7 material.	High content of organic matter to a depth of 6 inches; poor embankment material; fluctuating water table; moderate frost-heave potential; high plasticity.	High water table; slopes of 0 to 1 percent.	Low shear strength; high compressibility; impervious.
Scave: SIE, SKE	Good to a depth of 18 inches.	Poor: poorly graded; excessive fines; cobbly.	Fair to good: A-2 and A-4 material.	Cobbly; slopes of 10 to 30 percent; high frost-heave potential; high content of organic matter in upper 10 inches.	Slopes of 10 to 30 percent.	Medium shear strength; subject to piping; semipervious; medium compressibility.
Scout: SLG	Fair to a depth of 18 inches: gravelly loam.	Poor to good for sand: 15 to 45 percent fines; 50 to 60 percent gravel.	Fair to good: A-2 and A-4 material.	Slopes of 10 to 70 percent.	Slopes of 10 to 70 percent.	Medium to high shear strength; stable; susceptible to piping; semipervious; low compressibility.
Shay: Sm	Fair to a depth of 14 inches: silty clay loam.	Not suitable: excessive fines.	Poor: dominantly A-6 and A-7 material.	Poor embankment material; moderately high water table; high frost-heave potential; subject to flooding in spring; medium plasticity.	High water table; slopes of 0 to 1 percent.	Low to medium shear strength; medium to high compressibility; impervious to semipervious.
*Sheep Creek: SNG2, SOG2, SPG2, SRG2. For interpretations of Agassiz soil in SOG2, of Despain soil in SPG2, and of Maughan soil in SRG2, refer to their respective series.	Poor: cobbly.	Fair to poor: 15 to 50 percent fines; 40 to 80 percent gravel.	Fair to good: A-2 and A-4 material.	Bedrock at a depth of 26 to 40 inches; slopes of 30 to 70 percent; very cobbly.	Bedrock at a depth of 26 to 40 inches; slopes of 30 to 70 percent.	Medium to high shear strength; semipervious to pervious; low compressibility; susceptible to piping.
*Smarts: SSE, STG2, SUG For interpretations of Hoskin soil in STG2, and of Lucky Star and Poleline soils in SUG, refer to their respective series.	Good to a depth of 15 inches; fair between depths of 15 inches and 22 inches: gravelly; some cobblestones.	Fair to good below a depth of 22 inches: 15 to 30 percent fines; 50 to 85 percent gravel.	Fair to good: A-2 and A-4 material.	Cobbly; slopes of 10 to 70 percent; high content of organic matter in upper 22 inches.	Slopes of 10 to 70 percent.	Low to medium shear strength; susceptible to piping; semipervious to impervious; medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Very slow permeability; high water table; fine texture; gravity outlets are difficult to obtain.	Slow intake rate; high water table; large amount of organic matter on surface.	Not applicable	Not applicable	Very severe: water table at a depth of 0 to 30 inches; high shrink-swell potential; poorly and very poorly drained.	Severe: very slow permeability; water table at a depth of 0 to 30 inches.	Severe: high content of organic matter; water table at a depth of 0 to 30 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 10 to 30 percent; moderate shrink-swell potential.	Severe: slow permeability below a depth of 34 inches; slopes of 10 to 30 percent.	Severe: slopes of 10 to 30 percent.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 10 to 70 percent.	Severe: slopes of 10 to 70 percent.	Severe: slopes of 10 to 70 percent.
Slow permeability; high water table; stratified substratum; subject to flooding; gravity outlets difficult to obtain in some areas; fine texture.	Slow intake rate; high water table; subject to flooding.	Not applicable	Not applicable	Severe: water table at a depth of 30 to 50 inches; high shrink-swell potential; somewhat poorly drained.	Severe: slow permeability; water table at a depth of 30 to 50 inches.	Moderate: water table at a depth of 30 to 50 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Severe: slopes of 30 to 70 percent; bedrock at a depth of 26 to 40 inches.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 26 to 40 inches.	Severe: slopes of 30 to 70 percent; bedrock at a depth of 26 to 40 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 10 to 70 percent.	Severe: slopes of 10 to 70 percent.	Severe: slopes of 10 to 70 percent.

TABLE 4.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—		
					Farm ponds	
	Topsoil	Sand and gravel	Road fill	Highway location	Reservoir area	Embankment
Steed: SvA, SvB, SvC	Fair to a depth of 18 inches: gravelly loam.	Fair to good below a depth of 17 inches: 10 to 25 percent fines; 5 to 80 percent gravel.	Fair to good: A–2 and A–4 material.	Slopes of 0 to 10 percent.	Slopes of 0 to 10 percent.	Pervious to semipervious; medium to high shear strength; low compressibility; susceptible to piping.
Sterling: SwC, SwD, SwF2	Fair to a depth of 16 inches: gravelly loam.	Good to fair below a depth of 16 inches: 5 to 25 percent fines; 50 to 90 percent gravel.	Good below a depth of 16 inches: A–1 material.	Slopes of 6 to 50 percent.	Slopes of 6 to 50 percent.	Pervious; medium to high shear strength; low compressibility.
Stony alluvial land: Sy. Onsite investigation required.						
Timpanogos: TmA, TmB, TmC, TmD2, TnA.	Good	Not suitable: excessive fines.	Fair: A–4 material.	Occasional high water table; moderate frost-heave potential; slopes of 0 to 20 percent.	Occasional high water table; slopes of 0 to 20 percent.	Susceptible to piping; semipervious to impervious; low to medium shear strength; medium compressibility.
Trenton: TrA, TrB, TrC, TrD2, TtA.	Fair to a depth of 8 inches; poor below a depth of 8 inches: high water table; salts and alkali.	Not suitable: excessive fines.	Poor: A–7 material.	Poor for embankment material; high water table; moderate frost-heave potential; high plasticity; slopes of 0 to 20 percent.	High water table; slopes of 0 to 20 percent.	Impervious; high compressibility; low shear strength.
*Wheelon: WhE, WhF2, WlE2. For interpretations of Collinston soil in WlE2, refer to the Collinston series.	Poor: moderately to strongly calcareous.	Not suitable: excessive fines.	Fair: A–4 material.	High frost-heave potential; slopes of 10 to 70 percent.	Slopes of 10 to 70 percent.	Susceptible to piping; low to medium shear strength; medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Not applicable	Moderately rapid intake rate; low available water capacity; slopes of 0 to 10 percent.	Not applicable	Gravelly texture; low available water capacity below a depth of 17 inches; slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent.	Slight to moderate: slopes of 0 to 10 percent; possible ground water contamination.	Severe: very rapid permeability below a depth of 17 inches.
Not applicable	Moderately rapid intake rate; low available water capacity; gravelly; slopes of 6 to 50 percent.	Very gravelly texture; rapid permeability below a depth of 16 inches; slopes of 6 to 50 percent.	Very gravelly; slopes of 6 to 50 percent.	Slight to severe: slopes of 6 to 50 percent.	Moderate to severe: slopes of 6 to 50 percent; possible ground water contamination.	Severe: slopes of 6 to 50 percent; very gravelly; rapid permeability below a depth of 16 inches.
Generally not applicable; water table at a depth of 36 to 54 inches; moderate permeability.	Moderate intake rate; high water table; needs drainage in some areas; slopes of 6 to 20 percent are best suited to sprinkler irrigation.	Moderately permeable; water table at a depth of 36 to 54 inches in some areas; slopes of 0 to 20 percent.	High water table at a depth of 36 to 54 inches in some areas; slopes of 0 to 20 percent.	Moderate to severe: water table in some areas below a depth of 36 inches; slopes of 0 to 20 percent; moderate shrink-swell potential.	Moderate to severe: water table in some areas below a depth of 36 inches; slopes of 0 to 20 percent; moderate permeability.	Moderate to severe: slopes of 0 to 20 percent; moderate permeability.
Slow permeability; high water table; fine texture.	Slow intake rate; high water table; slight to severe salinity; alkali; fine texture; slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Slopes of 0 to 20 percent.	Severe: water table at a depth of 28 to 60 inches; high shrink-swell potential; slopes of 0 to 20 percent; somewhat poorly to moderately well drained.	Severe: water table at a depth of 28 to 60 inches; slow permeability; slopes of 0 to 20 percent.	Moderate to severe: slopes of 0 to 20 percent; water table at a depth of 28 to 60 inches.
Not applicable	Moderately slow intake rate; slopes of 10 to 70 percent; highly erodible.	Moderately slow permeability; slopes of 10 to 70 percent.	Slopes of 10 to 70 percent.	Moderate to severe: slopes of 10 to 70 percent; moderate shrink-swell potential; bedrock at a depth of 24 inches to more than 60 inches.	Severe: slopes of 10 to 70 percent; bedrock at a depth of 24 inches to more than 60 inches.	Severe: slopes of 10 to 70 percent; bedrock at a depth of 24 inches to more than 60 inches.

TABLE 4.—*Engineering*

	Suitability as a source of—			Soil features affecting—		
Soil series and map symbols	Topsoil	Sand and gravel	Road fill	Highway location	Farm ponds	
					Reservoir area	Embankment
*Winn: Wn, Wp For interpretations of Provo in Wp, refer to the Provo soil series.	Good	Not suitable: excessive fines.	Fair: A–4 material.	Seasonal high water table; moderate frost-heave potential; subject to spring flooding; slopes of 0 to 3 percent.	Seasonal high water table; slopes of 0 to 3 percent.	Susceptible to piping; semipervious to impervious; low to medium shear strength; medium compressibility.
Woods Cross: Wr	Poor below a depth of 8 inches; high content of organic matter; high water table; heavy silty clay loam.	Not suitable: excessive fines.	Poor: A–7 or A–6 material.	Peat and high content of organic matter in upper 8 inches; poor embankment material; high water table; high frost-heave potential; high plasticity.	High water table; slopes of 0 to 1 percent.	Low to medium shear strength; impervious to semipervious; low compressibility; susceptible to piping.
Yeates Hollow: YHE, YHG, YLE2.	Poor: extremely stony silt loam.	Poor: fine texture; stony and cobbly.	Fair to good: A–2 and A–4 material.	Stony and cobbly; rock fragments below a depth of 40 inches; fines plastic; slopes of 3 to 70 percent.	Bedrock below a depth of 40 inches; slopes of 3 to 70 percent.	Impervious; medium to high shear strength; low to medium compressibility.

interpretations of soils—Continued

Soil features affecting—Continued				Degree and dominant limitations for—		
Agricultural drainage	Irrigation	Terraces and diversions	Grassed waterways	Foundations for low buildings	Septic tank filter fields	Sewage lagoons
Moderate permeability; seasonal high water table; stratified substratum; subject to flooding; gravity outlets difficult to obtain in some areas.	Moderate intake rate; seasonal high water table; seasonal flooding.	Not applicable	Not applicable	Moderate: water table at a depth of 30 to 50 inches; moderate shrink-swell potential; somewhat poorly drained.	Moderate: water table at a depth of 30 to 50 inches.	Moderate: moderate permeability; water table at a depth of 30 to 50 inches.
Slow permeability; high water table; stratified substratum; fine texture.	Moderately slow intake rate; high water table; fine texture; organic matter on surface in some areas.	Not applicable	Not applicable	Severe: high water table at a depth of 10 to 30 inches; high shrink-swell potential; poorly drained.	Severe: high water table at a depth of 10 to 30 inches; slow permeability.	Severe: high content of organic matter; high water table at a depth of 10 to 30 inches.
Not applicable	Not applicable	Not applicable	Not applicable	Moderate to severe: slopes of 3 to 70 percent; moderate shrink-swell potential; bedrock at a depth of 40 inches to more than 60 inches.	Severe: slopes of 3 to 70 percent; slow permeability; bedrock at a depth of 40 inches to more than 60 inches.	Severe: slopes of 3 to 70 percent; bedrock at a depth of 40 inches to more than 60 inches.

TABLE 5.—*Engineering*

[Tests were performed by U.S. Department of Commerce, Bureau of Public Roads, in accordance

Soil name and location	Depth from surface	Mechanical analysis [1]					
		Percentage passing sieve—					
		1½-inch	1-inch	¾-inch	⅜-inch	No. 4 (4.7 mm)	No. 10 (2.0 mm)
	Inches						
Lewiston fine sandy loam: 850 feet N. and 1,100 feet E. of SW. corner of NE ¼ sec. 18, T. 14 N., R. 1 E. (Modal)	0–10	--------	--------	--------	--------	--------	100
	13–22	--------	--------	--------	--------	--------	100
	32–50	--------	--------	--------	--------	--------	100
Logan silty clay loam: 1,100 feet S. and 500 feet E. of NW. corner of NE¼ sec. 16, T. 11 N., R. 1 W. (Modal)	0–13	--------	--------	--------	--------	--------	--------
	13–26	--------	--------	--------	--------	--------	100
	26–45	--------	--------	--------	--------	--------	--------
Mendon silt loam: 700 feet N. and 40 feet W. of SE. corner of SW¼ sec. 1, T. 13 N., R. 2 W. (Modal)	0–7	--------	--------	--------	--------	--------	100
	7–24	--------	--------	--------	--------	--------	100
	28–34	--------	--------	--------	--------	--------	100
	34–40	100	99	99	98	97	96
Nebeker silt loam: 20 feet N. and 100 feet W. of SE. corner of NW¼ sec. 14, T. 10 N., R. 1 E. (Modal)	0–8	[4] 99	99	99	99	98	97
	26–55	100	98	97	96	94	92
	55–70	100	99	97	89	82	78
Ricks gravelly loam: 700 feet N. and 200 feet E. of SW. corner of sec. 2, T. 10 N., R. 1 E. (Modal)	0–4	[4] 99	97	95	91	88	86
	4–9	100	98	96	92	90	87
	18–24	[5] 81	68	60	43	31	24
Trenton silty clay loam: 200 feet N. and 600 feet W. of SE. corner of NW¼ sec. 29, T. 14 N., R. 1 E. (Modal)	0–8	--------	--------	--------	--------	--------	--------
	8–15	--------	--------	--------	--------	--------	--------
	26–34	--------	--------	--------	--------	--------	--------
	34–60	--------	--------	--------	--------	--------	--------

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[1] Mechanical analysis according to AASHO Designation: T 88–57 (*1*). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for naming textural classes for soils.

test data

with standard procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [1]—Continued							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Con.			Percentage smaller than—						AASHO [1]	Unified [2]
No. 40 (0.42 mm)	No. 60 (0.25 mm)	No. 200 (0.074 mm)	0.05 mm	0.02 mm	0.005 mm	0.002 mm				
99	89	25	23	17	11	9	[3] NP	[3] NP	A-2-4(0)	SM
99	90	26	23	20	17	14	NP	NP	A-2-4(0)	SM
98	88	17	14	12	9	8	NP	NP	A-2-4(0)	SM
------------	100	98	96	83	61	45	61	23	A-7-5(17)	MH
99	99	96	93	82	58	43	46	20	A-7-6(13)	ML-CL
------------	----------	100	99	94	79	67	58	30	A-7-6(20)	CH
99	95	85	81	60	36	27	28	8	A-4(8)	CL
99	98	94	91	73	50	40	44	21	A-7-6(13)	CL
95	91	82	76	57	38	29	37	16	A-6(10)	CL
86	81	68	62	47	33	26	39	17	A-6(9)	CL
95	94	89	84	58	32	23	28	7	A-4(8)	ML-CL
88	86	81	79	70	60	55	71	40	A-7-5(20)	CH
72	71	55	48	34	22	20	31	13	A-6(5)	CL
81	78	64	58	36	21	15	26	7	A-4(6)	ML-CL
81	78	64	56	36	21	16	28	10	A-4(6)	CL
17	14	10	8	6	3	2	NP	NP	A-1-a(0)	GP-GM
------------	100	99	98	80	48	32	34	13	A-6(9)	CL
------------	100	99	99	92	73	59	63	35	A-7-6(20)	CH
------------	----------	----------	100	98	78	58	58	34	A-7-6(20)	CH
------------	----------	----------	100	99	84	64	65	40	A-7-6(20)	CH

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[2] SCS and BPR have agreed to consider that all soils having plasticity indexes within two points of A-line are to be given a borderline classification. An example of a borderline classification obtained by this use is ML-CL.

[3] Nonplastic.

[4] 100 percent passed the 2-inch sieve.

[5] 88 percent passed the 2-inch sieve, and 100 percent passed the 3-inch sieve.

Agricultural scientists classify soil texture according to the system of the United States Department of Agriculture. Soil material smaller than 2.0 millimeters in diameter is classified in three size fractions as clay, silt, or sand. The percentages of the three size fractions determine the textural classification of the soil material.

The estimated percentage of soil that passes through sieves Nos. 4, 10, and 200 reflects the normal range for a soil series. Most soils within the series are within the range given, but the grain size of any soil varies considerably. Therefore, all samples of a specific soil may not be within the range and the engineering classification may vary from that shown.

Estimates of permeability are for the soil in place. They are based on the structure, texture, and porosity of the soil material and on field observations.

The available water capacity, given in inches per inch of soil, is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point.

Reaction gives the intensity of acidity or alkalinity of the soil, expressed in pH values. A pH of 7.0 is neutral. A lower value indicates acidity, and a higher value indicates alkalinity. The pH value is an indication of the corrosiveness of the soil solution to pipelines and other structures placed in the ground.

Salinity affects the suitability of a soil for crops, its stability when used as a construction material, and its corrosiveness to other materials.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. In general, soils that have a high shrink-swell potential present hazards to engineering structures constructed in, on, or with such material.

Engineering Interpretations

Table 4 provides suitability ratings of soils as a source of topsoil, sand, gravel, and road fill; describes soil features that affect stated engineering practices; and rates soils for their limitations in use as foundations of low buildings, for septic tank filter fields, and for sewage lagoons. Interpretations are based on test data and on field experience with soils in the survey area and with similar soils.

Soils are rated poor or fair as a source of topsoil if they are eroded, are low in content of organic matter or natural fertility, or have a heavy and sticky surface layer that is difficult to handle or till. Soils rated suitable as sources of sand or gravel may require extensive exploration to find material that meets specific requirements.

The soils in the survey area have been rated on the degree and dominant kind of limitation that affects their use as foundations for low-rise buildings, septic tank filter fields, and sewage lagoons. Ratings have meanings as follows:

Slight means that the soil has a few limitations that are easily overcome.

Moderate means that the soil has limitations that need to be recognized. The limitations can be overcome by proper planning, careful design, and good management.

Severe means that the soil limitations are severe enough to make the use of the soil questionable. Careful planning and above-average management are required.

Very severe means that the soil is not suited to the intended use and that extreme measures are needed to overcome limitations.

The ratings are based only on soil properties. The main properties that were considered in rating the soils are drainage, height of the water table, depth of soil, texture, kind of parent material, kind of clay, permeability, salt and alkali content, degree of slope, and stoniness. Other factors that can be important in the selection of an area for a specific use were not considered. The ratings are general and should not be used as a substitute for detailed investigations at the site proposed for development. The soil property or quality that is most restrictive to the stated use determined the rating. Ratings apply to soil material to a depth of 5 feet unless otherwise stated.

The selection and use of soils as foundations for buildings of 3 stories or less is determined mainly by soil texture, permeability, drainage, height of the water table, content of salts and alkali, shrink-swell potential, and slope. The foundation of a building transmits the weight of the structure onto the natural undisturbed soils.

The Unified soil classification system has been used to evaluate the soils in terms of their bearing capacity, compressibility, and shear strength. The density and consistency of a given soil vary, and individual site investigations will need to be made. Ratings are made with the assumption that noncohesive soils have a loose to medium relative density and cohesive soils have a soft to medium consistence. Although slope is not actually a factor that affects the foundation, it presents problems in construction and is, therefore, considered in these ratings. Special design for buildings and construction methods are needed on steep soils, but some areas of these steep soils have a definite esthetic advantage as they occur in areas where the view is unobstructed. The substratum of the soil generally provides the base for foundations and, therefore, is the soil material which is rated for foundations. Soils that have bedrock or a hardpan within a depth of 60 inches have slight limitations unless basements or underground utilities are planned.

The effectiveness of a septic tank filter is determined largely by the following soil properties: texture, permeability, depth to consolidated rock or other impervious layers, hazards of flooding or overflow, natural drainage, height of the water table, and slope.

Soils that have moderate to very rapid permeability (more than 1 inch per hour) are rated as having *slight* limitations. Soils that have a permeability at the slower end of the moderate range (about 1.0 to 0.63 inches per hour) are rated as having *moderate* limitations. Soils that have moderately slow and slow permeability (0.63 to 0.063 inches per hour) are rated as having *severe* limitations. Soils that have very slow permeability (less than 0.063 inches per hour) are rated as having *very severe* limitations. Coarse-textured soils (loamy sands, sand, and gravel) are relatively poor filtering material. These soils allow unfiltered sewage to flow long distances, and this sewage is a pollution hazard where water supplies, streams, ponds, lakes, or water courses are nearby. Coarse-textured soils that have very rapid permeability have severe to very severe limitations where there is a pollution hazard. A seasonal water table should be at least 4 feet below the surface. Well drained and moderately well drained soils that have a water table below a depth of 48 inches are rated as having a *slight* limitation. Somewhat poorly drained and moderately well drained soils that have a water table at a depth of less than 48 inches are rated as having *moderate* limitations; poorly drained and very poorly drained soils that have a shallow water table are rated as having *severe* limitations. Where bedrock or indurated hardpan is within a depth of 48 inches, the soils are rated as having *moderate* to *very severe* limitations. Soils that are frequently flooded are not suitable for septic tank filter fields. Slopes of less than 10 percent are the most desirable. Mechanical limitations in layout and construction increase with steepness of slope. The ratings listed in table 4 do not include the hazard of pollution. This factor should be evaluated through onsite investigation.

A sewage lagoon is a shallow lake used to hold sewage for bacterial decomposition. Sewage lagoons require consideration of the soil as a floor for the impounded area and as material for the dam. The requirements for the dam are the same as for other embankments designed to impound water. There must be adequate soil material available that is suitable for the structure and, when properly constructed, the lagoon must be capable of holding water with minimum seepage. The main soil properties considered in the rating for sewage lagoons are texture, permeability, depth to bedrock, organic matter, coarse fragments, and slope.

The Unified soil classification system has been used in evaluating both the reservoir site material and the embankment material. Soil material over bedrock must be thick enough so that smoothing required to obtain the specified uniformity in depth of the lagoon is practical. Moderate to high amounts of organic matter in a lagoon promote aquatic plant growth, which is detrimental.

Fragments more than 6 inches in diameter interfere with movement and compaction of the soil material in the process of smoothing the basin floor. Slopes must be relatively flat to meet the restrictions on depth (2 to 5 feet) of the liquid body in sewage lagoon.

Such factors as height of the water table, distance of the lagoon from homes, future expansion, prevailing wind, and hazard of pollution are important factors that have not been evaluated here. They require investigation at the site proposed for use as a sewage lagoon.

Engineering Test Data

Table 5 shows engineering test data for six different soil series. The soils were tested by the Bureau of Public Roads.

The engineering soil classifications are based upon data obtained by mechanical analyses and by tests to determine the liquid limit and plasticity index. Mechanical analyses were made by combined sieve and hydrometer methods.

The liquid limit is the moisture content at which soil material passes from a plastic state to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state. The plasticity index is the numerical difference between the liquid limit and the plastic limit.

Formation and Classification of the Soils[7]

This section describes how the factors of soil formation have affected the formation of soils in the Cache Area. It also places the soil series represented in this survey area in categories of the current system of classification.

Factors of Soil Formation

The characteristics of a soil at any given point are determined by the interaction of five principal factors: (1) the parent material, (2) the climate under which the soil material has accumulated and has existed since accumulation, (3) the relief, or topography, which influences the local or internal environment of the soil and its drainage, moisture content, aeration, susceptibility to erosion, and exposure to sun and wind, (4) the biological forces, or the plants and animals living on or in the soil that have acted upon the soil material, and (5) the length of time the climatic and biological forces have acted upon the soil material.

The soils in the Cache Area show the interaction of all five factors of soil formation.

Parent material

The soils on the flood plains, recent alluvial fans, valley floors, deltas, and lake terraces in Cache Valley have formed in transported mixed alluvium. This parent material was derived dominantly from limestone, sandstone, quartzite, dolomite, and conglomerate rocks. It was deposited in the Cache Valley by streams. The waters of old Lake Bonneville later moved and sorted some of this material and formed the lake terraces as the lake receded (*12*).

The McMurdie soils formed in the fine-textured, mixed lake sediment on high lake terraces, and they are probably the oldest of the lake terrace soils. Battle Creek soils formed in fine-textured sediment on slightly lower terraces. Timpanogos, Parleys, and Hillfield soils formed in medium-textured and moderately fine textured material on intermediate and high terraces. Lewiston and Kidman soils formed in moderately coarse textured sediment on broad intermediate lake terraces. Ricks, Sterling, and Steed soils formed in coarse-textured, gravelly and cobbly sediment deposited near the mouth of canyons on deltas and on high or intermediate terraces. Preston soils formed in coarse-textured sediment that was modified by the action of wind after the lake receded.

The soils on the low lake terraces and on the floor of Cache Valley are somewhat poorly drained or poorly drained. Greenson, Roshe Springs, and Logan soils formed in the medium-textured and moderately fine textured sediment on the low terraces and on the floor of Cache Valley. Collett, Salt Lake, Trenton, and Nibley soils formed in the fine-textured sediment.

Recent post-Bonneville alluvium, deposited on flood plains and fans on the floor of Cache Valley, is the parent material for the Winn, Kirkham, and Shay soils. Winn soils formed in medium-textured material, Kirkham in moderately fine textured material, and Shay soils in fine textured material. These soils are somewhat poorly drained and are stratified.

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[7] THERON B. HUTCHINGS, soil scientist, Soil Conservation Service, assisted in the preparation of this section.

Local post-Bonneville alluvium, derived mostly from dolomitic rocks from Green Canyon, deposited as alluvial fans on intermediate terraces, is the parent material of the Green Canyon and Millville soils. These soils contain more than 40 percent carbonates. Green Canyon soils are higher on the fans than Millville soils, and they formed in very gravelly and cobbly, medium-textured material. Millville soils formed in medium-textured, nongravelly material lower on the fans. In places the Millville soils have a deep water table.

Light-colored rocks of Tertiary Age and tuffaceous standstone, tuff, and fresh limestone, commonly called the Salt Lake Formation, are the source of the parent material for a number of soils (*12*). This formation occurs both within and above the Lake Bonneville basin. Avon, Mendon, Crookston, Collinston, and Wheelon soils formed in material from the Salt Lake Formation that was moved and sorted by the waters of Lake Bonneville. Barfuss, Leatham, and LaPlatta soils are above the highest water level of Lake Bonneville. This material is mostly medium textured to fine textured. Crookston, Collinston, and Wheelon soils formed in the medium-textured material; Mendon, Leatham, and Barfuss soils formed in the moderately fine textured material; and Avon and LaPlatta soils formed in the fine textured material. These soils are relatively high in content of silt, and they contain a significant amount of volcanic ash or glass. They have high cation-exchange capacity and contain clays in which a 2:1 lattice type is dominant. These soils contain more than 2 milliequivalents of exchangeable potassium per 100 grams of soil.

In the mountainous areas, the parent material was derived from old Precambrian to the younger Tertiary rocks. These rocks are dominantly limestone, dolomite, quartzite, sandstone, and conglomerate. The soils in these areas formed in residuum, colluvium, and alluvium derived from these rocks. These soils vary widely in texture and in depth to bedrock.

Only a few soil characteristics or qualities have been noted that are related to a particular geologic formation.

Goring, Hoskin, Curtis Creek, St. Marys, Lucky Star, Scave, Cluff, Red Spur, and Scout soils formed mostly in material derived from red sandstone and conglomerate rocks of the Wasatch Formation. These soils are essentially free of carbonates and have color hues of 7.5YR or redder below the A horizon. The St. Marys and Hoskin soils formed in very cobbly residuum and colluvium derived from Wasatch conglomerate. More than 50 percent of their profile is rounded cobblestones and gravel.

Climate

The climate in the Cache Area ranges from dry subhumid to moist subhumid continental. Winters are cold, and summers are warm. Average annual precipitation generally ranges from 14 to 35 inches. Most of the precipitation is snow that falls from October to April. Seasonal and daily temperatures vary widely. The frost-free season on the floor of Cache Valley and on the lake terraces is 120 to 160 days. In the high, mountainous areas, frosts have occurred in every month of the year. Temperatures of less than 20° F. during winter and temperatures of more than 100° during summer are common.

In general, the climate and elevation are co-factors in the formation of soils. The amount of precipitation increases with increases in elevation. The relationship between climatic factors and elevation varies somewhat with exposure. Because of the exposure, there is some overlap in elevation in the different designated climate zones. On the floor of Cache Valley and on the lake terraces at elevations of 4,420 to 5,000 feet, the average annual precipitation is generally between 14 and 17 inches and the mean annual air temperature is 45° to 48°. These areas are referred to as the Upland climatic zone. Some high lake terraces, the high fans, and the foothill areas at elevations of 5,000 to 6,000 feet generally have 17 to 20 inches of precipitation annually and have a mean annual air temperature of 45° to 48°. This general area is transitional between the Upland climatic zone and the Mountain Climatic zone, depending a great deal on exposure and position.

In mountainous areas at elevations of 6,000 to 7,200 feet, the average annual precipitation generally is 20 to 25 inches, and the mean annual air temperature is 40° to 45°. This area is in the Mountain climatic zone. It is colder and receives more precipitation than the lower areas. The areas above 7,000 to 7,200 feet are in the High Mountain climatic zone. The average annual precipitation generally is 25 to 35 inches, and the mean annual air temperature is 36° to 42°. Typically, the soils above the 7,000 feet elevation, under vegetative cover of aspen or conifers, have an average soil temperature in summer of less than 60°.

The influence of climate is noticeable mainly in the amount of organic-matter accumulation in the surface layer and the translocation of minerals and clays to form distinct horizons.

Much of the moisture that falls during winter and early in spring is stored in the soil or percolates through the soil. Percolation has removed the more soluble salts from the soils on the high lake terraces, the high fans, and the mountains. In the Mountain and High Mountain climatic zones, the carbonates have either been translocated to form distinct lime horizons or have been leached from the soil.

Following or accompanying the leaching of carbonates, some silicate clay has been translocated or formed in place by alteration of minerals to form a B2t horizon.

In the Upland climatic zone, the Hillfield and Wheelon soils have a light-colored A1 horizon and a distinct lime horizon but no other horizonation. The Collinston and Sterling soils have a distinct lime horizon and a thin, dark-colored A1 horizon but very little other horizonation. The Ricks, Timpanogos, Parleys, and Battle Creek soils have a thin, dark A1 horizon, a weak to moderate B2t horizon, and a distinct lime horizon.

In the Mountain climate zone, the Sheep Creek, Datwyler, and Ant Flat soils have a thin, dark A1 horizon, a moderately developed to strongly developed B2t horizon, and a distinct lime horizon. The Crookston, Mendon, Avon, Barfuss, LaPlatta, Despain, Clegg, and McMurdie soils have a thick, dark A1 horizon. The organic-matter accumulation and dark colors extend to a depth of more than 20 inches. These soils have a moderately developed to strongly developed B2t horizon and a distinct lime horizon. The Goring, Hendricks, and Nebeker soils also have organic-matter accumulation and dark colors that extend to a depth of more than 20 inches, and they have a strong B2t horizon. In these soils, essentially all the carbonates are leached to a depth of 60 inches or more.

In the High Mountain precipitation zone, percolation has removed much of the soluble minerals and has translocated the silicate clays. A light-colored, bleached A2 horizon has formed in the Lucky Star, Red Spur, Scave, Flygare, Fitzgerald, and Cluff soils. These soils have a moderately developed to strongly developed B2t horizon below the A2 horizon. Carbonates and most soluble salts have all been leached from the soil.

The soils on the lower terraces and flood plains receive runoff from higher areas and in some places from upward-moving ground water. In many places this additional moisture has caused a high water table and impaired drainage. The Logan, Salt Lake, Greenson, Collett, Winn, and Roshe Springs series are examples of soils that formed under these conditions. These soils are calcareous throughout the profile and contain a distinct horizon where lime has accumulated. Soluble salts and alkali have accumulated in some soils of the valley bottoms and low terraces. The Cache soils for example, contain a large amount of soluble salts. The Trenton, Payson, and Airport soils are strongly alkali. These soils have a moderately developed to strongly developed horizon that has a prismatic or columnar structure. They have a high content of exchangeable sodium and a distinct horizon of lime accumulation.

Relief

Relief or landform influences soil formation principally by its effect on runoff, drainage, and microclimate. The dominant landforms or topographic features in the Cache Area are (1) valley floors, low terraces, and flood plains, (2) lake terraces, terrace escarpments, and deltas, (3) high fans, and (4) foothills and mountains.

Valley floors, lower terraces, and flood plains.—Drainage is slow on the level to gently sloping valley floors, stream flood plains, and low terraces of Cache Valley. In places the soils are ponded or have a high water table. These wet soils lack oxygen and are gleyed. The iron oxide and other compounds in the soil are reduced. Olive, yellowish, and bluish colors have formed, especially in the subsoil. The wetness causes water-loving plants to produce abundantly. This resulted in a high organic-matter content and dark colors in the surface layer of the Logan, Roshe Springs, and Salt Lake soils. The Winn, Kirkham, and Shay soils are similar to these soils and are typically on flood plains of permanent streams. The water table fluctuates, and the soils have yellowish mottles below a depth of 16 to 20 inches. In places these soils are subject to overflow from streams.

Trenton, Quinney, Airport, Payson, Lasil, and Jordan soils are on the low lake terraces. These soils have a moderately to strongly developed B horizon that has prismatic or columnar structure and is high in content of exchangeable sodium (natric horizon). Sodium clays have the property of swelling and dispersing when they are wet. Pore space, permeability, and aeration are greatly reduced. In drying, the soil mass contracts and cracks develop. Continuous wetting and drying forms distinct cleavages, and a typical prismatic or columnar structure forms in the B horizon.

Lake terraces, terrace escarpments, and deltas.—The steplike terraces of prehistoric Lake Bonneville are a prominent landform (*4*). The oldest terrace, the alpine level, has an elevation of 5,050 feet. The sediment is medium textured to fine textured and, in most places, is covered by sediment deposited when the lake was at its highest level. The McMurdie soils are on the old alpine terrace.

The highest terrace, the Bonneville, is readily observable throughout most of Cache Valley. The elevation is 5,135 feet. The Parleys, Mendon, and Timpanogos soils are dominant on this terrace. The B horizon in these soils is less distinct than in the McMurdie soils.

When the lake overflowed through Red Rock Pass, the water level decreased rapidly to an elevation of 4,820 feet and the upper Provo terrace was formed. Later the lake receded and formed another prominant terrace, the lower Provo, at an elevation of about 4,700 feet. The Ricks and Kidman soils are dominant on the Provo terraces. These soils have a weakly developed B horizon, and carbonates have been leached to a depth of 20 to 40 inches.

High fans.—The principal old fans in Cache Valley are in the Mountain climatic zone at elevations of 5,135 to 6,000 feet. They are generally just above the Bonneville terrace. In places these fans extend slightly below the Bonneville terrace. The dominant soils on these fans are the Hendricks, Crowshaw, Nebeker, and Hiibner. These soils are leached free of carbonates. They have a thick A1 horizon and a moderately developed to strongly developed B2t horizon.

Other high fans are at the foot of steep mountain slopes surrounding small valleys. Obray and some Yeates Hollow soils formed on these fans. These soils are fine textured. Obray soils are Vertic Haploxerolls that crack when they dry. Yeates Hollow soils have a strongly developed B2t horizon and are leached of carbonates.

Foothills and mountains.—These areas consist mostly of steep and very steep mountain slopes that have small intervening valleys and ridges, but they also include broad, sloping or moderately sloping foothills, fans, and stream terraces. The mountains surrounding Cache Valley rise rather abruptly from the high lake terraces. The elevation is 5,135 feet to more than 9,000 feet. The steep mountain slopes cause differences in climate. The steep south- and west-facing slopes are hot and dry. A considerable amount of snow melts, and the water runs off. The steep north- and east-facing slopes are cooler and more moist (fig. 18). Evaporation is less and the precipitation is used more efficiently. The vegetative cover is generally of different kinds and more dense on the north and east slopes at the same elevation. The Elzinga, Maughan, and Smarts soils are on northern exposures, mostly under dense cover of maple. They have a thick, dark A1 horizon and a moderately developed to strongly developed B2t horizon, and carbonates are leached to a depth of 60 inches or more. Maughan and Elzinga soils have a distinct A2 horizon. The Sheep Creek and Datwyler soils are at similar elevations but on south-facing slopes under a cover of shrubs and grasses. They have a

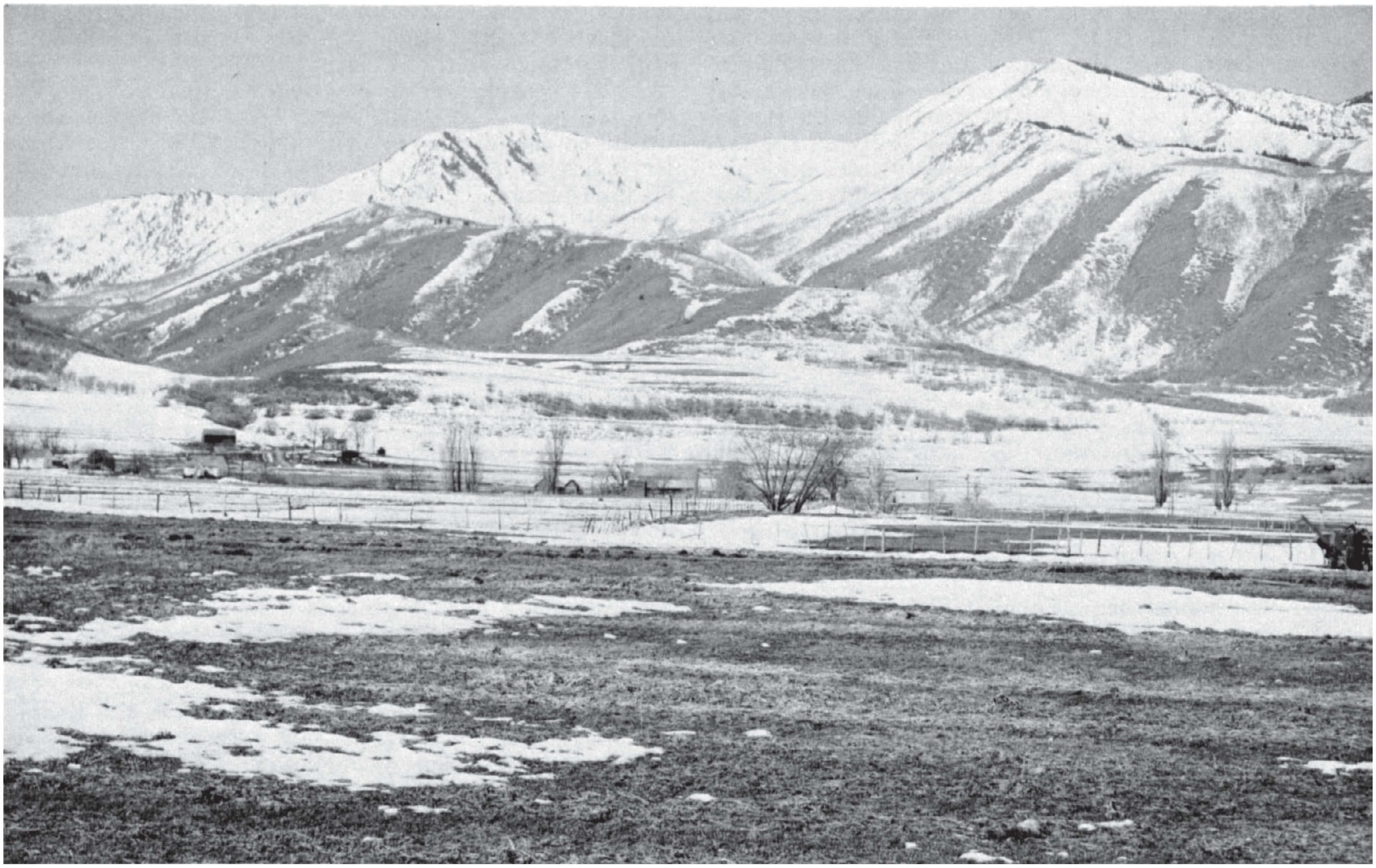

Figure 18.—East side of Wellsville Mountains showing the influence of aspect on the cover of snow. In the part of the mountains shown in the middle part of the picture, snow has remained on the north-facing slopes much longer than on the south-facing slopes. Mendon and Avon are the soils of the mountain that have north-facing slopes. Poleline and Datwyler soils have the south-facing slopes.

thinner solum, and carbonates have accumulated to form a lime horizon within a depth of 36 inches.

In the High Mountain climate zone, Douglas-fir, alpine fir, and aspen are dominant on the steep, north- and east-facing mountain slopes. At the higher elevations, aspen and coniferous trees also grow on southern and western exposures. The soils on these steep mountain slopes have a mean summer temperature of less than 59° F. at a depth of 20 inches. The Cluff and Fitzgerald soils that formed under conifers are extensively leached. They have a thin organic horizon, a thin, dark-colored A1 horizon, and a thick, bleached A2 horizon over a strongly developed B2t horizon. The percentage of base saturation is generally 50 to 75 percent. The Lucky Star, Red Spur, Flygare, and Scave soils that formed under aspen have a thick, dark-colored A1 horizon, a bleached A2 horizon, and a moderately developed to strongly developed B2t horizon.

Plants and animals

Plants strongly influence the kind, amount, and position of organic matter in the soil. Living organisms influence soil structure and porosity and thus influence the rate of air and water movement through the soil. Plants and animals mix the soil and may retard horizon formation. The decay of forest litter causes the formation of acids. These acids, in solution, hasten the leaching processes, and bases are leached rapidly from the soil.

The Cache Area contains the following six main plant zones:

Water-loving plant zone.—Reeds, sedges, saltgrass, foxtail, and wiregrass on the wet flood plains and valley bottoms contributed large amounts of organic matter to the Logan, Salt Lake, Roshe Springs, and Winn soils of this zone. These soils have a dark, thick A1 horizon. Some areas of these soils have been drained and are cultivated.

On the semiwet, low lake terraces and alluvial fans, the dominant vegetation is saltgrass, alkali sacaton, Kentucky bluegrass, foxtail, and some Great Basin wildrye. The somewhat poorly drained Nibley, Trenton, Greenson, Collett, and Lewiston soils have a moderate to moderately low organic-matter content.

Bunchgrass zone.—Here the dominant vegetation is bluebunch wheatgrass, western wheatgrass, tall native bluegrass, Great Basin wildrye, and other perennial grasses and a small amount of sagebrush, bitterbrush, and snowberry. This vegetation produced dark-colored soils that have a moderate to moderately high organic-matter content. Most of the soils are leached of lime in the surface horizon and have moderate to strong structure in the B2t horizon. The soils are well drained and are on the gently sloping to moderately steep, intermediate and high lake terraces, high alluvial fans, and mountain foot slopes. Runoff is slow to medium. The main soils that formed under grass vegetation are the Parleys, McMurdie, Hendricks, Goring, Mendon, Ant Flat, and Nebeker. Most areas of these soils are cultivated in Cache Valley. The Leatham soil has been extensively reworked by rodents and earthworms. Such mixing has partly offset soil horizonation, and the carbonates have been redistributed throughout the profile. Light-colored specks and chunks of material from the C horizon are readily visible in the A and B horizons. Worm casts and krotovinas are plentiful.

Upland and mountain shrub-browse zone.—In this zone the dominant vegetation is woody species, such as bitterbrush, big sagebrush, yellowbrush, serviceberry, ceanothus, oakbrush, snowberry, birchleaf mahogany, and scattered juniper. These areas also have a considerable amount of bluebunch wheatgrass, western wheatgrass, Sandberg bluegrass, and Great Basin wildrye. The Sheep Creek, Yeates Hollow, Datwyler, Picayune, Sterling, and Agassiz soils under this vegetation are mostly very gravelly and cobbly or shallow. Generally, they have an A horizon that is neutral in reaction and that has a moderately low to moderate content of organic matter. Some of the soils show weak or moderate development of a B horizon.

Deciduous tree zone.—In this zone the vegetation is dominantly aspen and maple on north- and east-facing slopes at the lower elevations and on all slopes at high elevations. Generally, the aspen trees are in open stands and have a dense understory of mountain brome, blue wildrye, slender wheatgrass, snowberry, serviceberry, and bluebells. The stands of maple trees are dense and have little grass-shrub understory. Dominant soils under aspen are the Lucky Star, Red Spur, Flygare, and Scave. These soils have a thick A1 horizon, a distinct A2 horizon, and a strongly developed B horizon. In the Lucky Star and Red Spur soils, the B2t horizon is being broken down as evidenced by deep tonguing of the A2 horizon into the B horizon. The Mult soils, also under aspen, have formed on hard limestone and lack an A2 horizon. The main soils under maple are the Elzinga, Maughan, and Smarts.

Conifer tree zone.—In this zone the tree species are dominantly Douglas-fir, alpine fir, Engelmann spruce, and white fir. These trees are generally on northern and eastern exposures at elevations above 7,000 feet, but they also are on other exposures at the higher elevations. These trees have contributed comparatively small amounts of material to form organic matter in the soils. However, the organic acids formed by the decay of the litter from these trees have been effective in hastening leaching. Most of the soils under the coniferous trees are medium acid to slightly acid in reaction and are comparatively low in bases. The Cluff and Fitzgerald soils have a thin or no A1 horizon, a distinct A2 horizon, and a moderately developed to strongly developed B horizon. Other soils under conifers are the Bickmore, Dateman, and Elwood. These soils have formed in hard material weathered from limestone, and their horizons are not so distinct as those of other soils under conifers.

Time

Soil formation requires time. It may be a matter of centuries or a few years. The distinctness of soil horizons depends in part on the amount of time the processes of soil development have had to act.

Among the soils of the Cache Area, the young soils on the alluvial fans have the lowest degree of horizonation. The only horizon formed in the Steed, Millville, Green Canyon, and Dagor soils, all of which are on alluvial fans, is the accumulation of organic matter in the A1 horizon.

The alpine terrace of Lake Bonneville is believed to have formed during Illinoian time. The McMurdie soils that formed on this terrace have a thick, dark, leached A1 horizon and a distinct B horizon. The accumulation of organic matter extends to a depth of 30 to 36 inches. Silicate clays have been translocated, and the clay content of the B2t horizon is almost double that of the A1 horizon. Slight increase in redness of color in the B horizon indicates some increase of iron oxides. Carbonates have been leached from the A horizon and upper part of the B horizon and have accumulated at a depth of 25 to 40 inches. The later Bonneville level and upper Provo level of Lake Bonneville are generally considered as having formed in early Wisconsin time, whereas the lower Provo level formed in the middle Wisconsin time. The Timpanogos and Parleys soils that formed on the Bonneville and upper Provo levels show less influence of time than the McMurdie soils. The increase in organic-matter content is not so deep in the profile. In most places only the upper 18 to 20 inches of the soil shows an increase in organic matter. There has been significantly less movement of clay, and carbonates have not been leached so deeply.

The soils that formed on the high old alluvial fans above the Bonneville level are older than those on the lake terraces. The Nebeker soils that formed on these fans have a dark A1 horizon. Organic matter has accumulated, and the soil generally is slightly acid to a depth of 48 inches or more. Strong, thick, reddish-colored clay horizons have formed, and carbonates have been leached to a depth of 60 inches or more. The B horizon has more than twice the content of clay of the A1 horizon. The reddish color indicates a considerable content of iron oxides.

The oldest soils in the Cache Area are probably those of the Goring, Lucky Star, and Red Spur series. These soils formed in material derived from sandstone that was very low in carbonates. Goring soils are in the Mountain climatic zone under grasses and shrubs. The Goring soils have a thick, dark A1 horizon and a thick, red, strongly developed B2t horizon. The B2t horizon is below a depth of 24 inches and has a hue of 7.5YR or redder and a chroma of generally more than 4.

The Red Spur and Lucky Star soils of the High Mountain climatic zone have a thick, dark, medium acid A1 horizon that is moderately high in organic matter; a thick, medium acid, sandy A2 horizon that has been stripped of clay; and a red, medium acid B horizon. There is considerable tonguing of the A2 horizon into the B horizon. The red B horizon in these soils is high in content of iron oxide.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and later revised (*7*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. It is under continual study (*6*, *10*). Therefore, readers interested in developments of the current system should search the latest literature available. The soil series of the Cache Area are placed in some categories of the current system in table 6.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar mode of origin are grouped together. Most of the classes of the current system are briefly defined in the following paragraphs.

ORDER.—Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate in the soil orders are those that tend to give broad climatic groupings of soils. The two exceptions, the Entisols and Histosols, occur in many different kinds of climate. Table 7 shows that the six soil orders in the Cache Area are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, and Alfisols.

Entisols are young soils that have only weakly formed horizons or lack distinct horizons. Either they have accumulated less than 1 percent organic matter in the surface soil, or the dark-colored A horizon is less than 7 inches thick. These soils lack a B horizon, and carbonates and other salts have not been accumulated in sufficient quantity to form a distinct horizon (calcic or salic horizon).

Vertisols are clayey soils that crack deeply when dry. When the cracks are open, some of the surface soil is eroded or moved into the openings. Repeated wetting and swelling and drying and cracking cause a churning action in the soils. This keeps the soils young and they have not formed strong horizons, other than an accumulation of organic matter in the surface soil and some leaching of carbonates to form a distinct lime horizon (calcic hori-

TABLE 6.—*Classification of soil series*

[Placement of some series in the present system of classification may change as more precise information becomes available]

Series	Family	Subgroup	Order	Great soil group (1938)
Agassiz	Loamy-skeletal, mixed, frigid	Lithic Haploxerolls	Mollisols	Lithosols.
Airport	Fine-silty, mixed, mesic	Typic Natraquolls	Mollisols	Solonetz soils.
Ant Flat	Fine, montmorillonitic, frigid	Calcic Argixerolls	Mollisols	Chestnut soils.
Avon	Fine, montmorillonitic, mesic	Calcic Pachic Argixerolls	Mollisols	Chernozems.
Barfuss	Fine-silty, mixed	Pachic Udic Argiborolls	Mollisols	Chernozems.
Battle Creek	Fine. mixed, mesic	Vertic Argixerolls	Mollisols	Chestnut soils.
Bickmore	Loamy-skeletal, mixed	Argic Pachic Cryoborolls	Mollisols	Chernozems intergrading toward Gray Wooded soils.
Blackrock	Fine-loamy, mixed, mesic	Cumulic Haploxerolls	Mollisols	Alluvial soils.
Bradshaw	Loamy-skeletal, mixed, frigid	Typic Haploxerolls	Mollisols	Bruinzems.
Cache	Fine, mixed, mesic	Typic Salorthids	Aridisols	Solonchak soils.
Cardon	Fine, montmorillonitic, mesic	Chromic Pelloxererts	Vertisols	Grumusols.
Center Creek	Fine-loamy, mixed	Pachic Argiborolls	Mollisols	Chestnut soils intergrading toward Humic Gley soils.
Clegg	Fine-loamy, mixed, frigid	Calcic Pachic Argixerolls	Mollisols	Brunizems.
Cluff	Clayey-skeletal, montmorillonitic	Mollic Cryoboralfs	Alfisols	Gray Wooded soils.
Collett	Fine, mixed, mesic	Aquic Calciustolls	Mollisols	Calcium-carbonate Solonchak soils.
Collinston	Fine-silty, mixed, mesic	Typic Calcixerolls	Mollisols	Calcisols.
Crookston	Fine-loamy, mixed, mesic	Calcic Pachic Argixerolls	Mollisols	Chestnut soils.
Crowshaw	Fine-loamy, mixed, mesic	Typic Haploxerolls	Mollisols	Brunizems.
Curtis Creek	Loamy, mixed, frigid	Lithic Argixerolls	Mollisols	Brunizems.
Dagor	Fine-loamy, mixed, mesic	Cumulic Haploxerolls	Mollisols	Alluvial soils.
Dateman	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols	Bruinizems.
Datwyler	Clayey - skeletal, montmorillonitic, frigid.	Calcic Argixerolls	Mollisols	Chestnut soils.
Despain	Fine-loamy, mixed, frigid	Calcic Pachic Argixerolls	Mollisols	Chestnut soils.

See footnote at end of table.

TABLE 6.—*Classification of soil series*—Continued

Series	Family	Subgroup	Order	Great soil group (1938)
Elwood	Loamy-skeletal, mixed	Argic Cryoborolls	Mollisols	Brunizems.
Elzinga	Loamy-skeletal, mixed	Pachic Paleborolls	Mollisols	Brunizems.
Fitzgerald	Loamy-skeletal, mixed	Mollic Paleboralfs	Alfisols	Gray Wooded soils.
Flygare	Loamy-skeletal, mixed	Cryic Pachic Paleborolls	Mollisols	Gray Wooded soils.
Foxol	Loamy-skeletal, mixed, frigid	Lithic Haploxerolls	Mollisols	Lithosols.
Goring	Fine, montmorillonitic, frigid	Pachic Palexerolls	Mollisols	Brunizems.
Green Canyon	Loamy-skeletal, carbonatic, mesic	Typic Haploxerolls	Mollisols	Alluvial soils.
Greenson	Fine-silty, mixed, mesic	Aquic Calciustolls	Mollisols	Calcium-carbonate Solonchak soils.
Hendricks	Fine-silty, mixed, mesic	Pachic Argixerolls	Mollisols	Brunizems.
Hiibner	Clayey , skeletal, montmorillonitic, mesic.	Typic Argixerolls	Mollisols	Brunizems.
Hillfield	Coarse-silty, mixed, mesic	Calcixerollic Xerochrepts	Inceptisols	Calcisols.
Hoskin	Loamy-skeletal, mixed, frigid	Typic Argixerolls	Mollisols	Brunizems.
Hyrum	Loamy-skeletal, mixed, mesic	Pachic Argixerolls	Mollisols	Brunizems.
Jordan	Fine, mixed, mesic	Salorthidic Natrustalfs	Alfisols	Solonetz soils.
Kidman	Coarse-loamy, mixed, mesic	Calcic Haploxerolls	Mollisols	Chestnut soils.
Kirkham	Fine-silty, mixed, mesic	Fluvaquentic Haplustolls	Mollisols	Alluvial soils.
Lakewin	Loamy-skeletal, mixed, mesic	Calcic Haploxerolls	Mollisols	Regosols.
LaPlatta	Fine, montmorillonitic	Pachic Udic Argiborolls	Mollisols	Chernozems.
Lasil	Fine-silty, mixed, mesic	Typic Natrustalfs	Alfisols	Solonetz soils.
Layton	Sandy, mixed, mesic	Calcic Haploxerolls	Mollisols	Regosols.
Leatham	Fine-silty, carbonatic, frigid	Typic Haploxerolls	Mollisols	Alluvial soils.
Lewiston	Coarse-loamy, mixed, mesic	Aeric Calciaquolls	Mollisols	Calcium-carbonate Solonchak soils.
Logan	Fine-silty, mixed, mesic	Typic Calciaquolls	Mollisols	Humic Gley soils.
Lucky Star	Loamy-skeletal, mixed	Cryic Paleborolls	Mollisols	Gray Wooded soils. Brunizems.
Maughan	Fine, montmorillonitic	Pachic Paleborolls	Mollisols	Brunizems.
McMurdie	Fine, montmorillonitic, mesic	Calcic Pachic Argixerolls	Mollisols	Brunizems.
Mendon	Fine-silty, mixed, mesic	Calcic Pachic Argixerolls	Mollisols	Chernozems.
Middle	Loamy-skeletal, mixed, mesic	Calcic Haploxerolls	Mollisols	Chestnut soils.
Millville	Coarse-silty, carbonatic, mesic	Typic Haploxerolls	Mollisols	Alluvial soils.
Mult	Fine-loamy, mixed	Argic Cryoborolls	Mollisols	Brunizems.
Munk	Loamy-skeletal, mixed, mesic	Typic Calcixerolls	Mollisols	Calcisols.
Nebeker	Fine, montmorillonitic, mesic	Pachic Argixerolls	Mollisols	Brunizems.
Nibley	Fine, mixed, mesic	Aquic Argiustolls	Mollisols	Chestnut soils.
Obray	Fine, montmorillonitic, frigid	Vertic Haploxerolls	Vertisols	Grumusols.
Parleys	Fine-silty, mixed, mesic	Calcic Argixerolls	Mollisols	Chestnut soils.
Parlo	Fine-silty over sandy or sandy skeletal, mixed, mesic.	Calcic Argixerolls	Mollisols	Chestnut soils.
Payson	Fine, mixed, mesic	Typic Natrustalfs	Alfisols	Solonetz soils.
Picayune	Fine-loamy, mixed, frigid	Calcic Haploxerolls	Mollisols	Chestnut soils.
Poleline	Loamy-skeletal, mixed	Pachic Cryoborolls	Mollisols	Lithosols.
Preston	Mixed, mesic	Typic Xeropsamment	Entisol	Regosols.
Provo	Sandy-skeletal, mixed, mesic	Typic Haplaquolls	Mollisols	Alluvial soils.
Quinney	Coarse-silty, mixed, mesic	Typic Natrixerolls	Mollisols	Solonetz soils.
Red Spur	Fine-loamy, mixed	Cryic Pachic Paleborolls	Mollisols	Gray Wooded soils.
Richmond [1]	Loamy-skeletal, carbonatic, mesic	Lithic Xerorthents	Entisols	Lithosols.
Ricks	Coarse-loamy over sand or sandy-skeletal.	Calcic Haploxerolls	Mollisols	Chestnut soils.
Roshe Springs	Fine-loamy, carbonatic, mesic	Typic Calciaquolls	Mollisols	Humic Gley soils.
St. Marys	Loamy-skeletal, mixed, frigid	Typic Haploxerolls	Mollisols	Brunizems.
Salt Lake	Fine, carbonatic, mesic	Typic Calciaquolls	Mollisols	Humic Gley soils.
Scave	Clayey-skeletal, montmorillonitic	Abruptic Cryic Paleborolls	Mollisols	Gray Wooded soils.
Scout	Loamy-skeletal, mixed	Typic Cryochrepts	Inceptisols	Sol Brun Acides.
Shay	Fine, montmorillonitic, mesic	Cumulic Haplustolls	Mollisols	Alluvial soils.
Sheep Creek	Loamy-skeletal, mixed, frigid	Calcic Argixerolls	Mollisols	Chestnut soils.
Smarts	Loamy-skeletal, mixed, frigid	Pachic-Ultic Argixerolls	Mollisols	Chernozems.
Steed	Fragmental, mixed, mesic	Entic Haploxerolls	Mollisols	Alluvial soils.
Sterling	Loamy-skeletal, mixed, mesic	Typic Calcixerolls	Mollisols	Calcisols.
Timpanogos	Fine-loamy, mixed, mesic	Calcic Argixerolls	Mollisols	Chestnut soils.
Trenton	Fine, mixed, mesic	Typic Natrixerolls	Mollisols	Solonetz soils.
Wheelon	Fine-silty, mixed, mesic	Calcixerollic Xerochrepts	Inceptisols	Calcisols.
Winn	Fine-loamy, mixed (calcareous), mesic	Cumulic Haplaquolls	Mollisols	Alluvial soils.
Woods Cross	Fine, montmorillonitic, noncalcareous, mesic.	Cumulic Haplaquolls	Mollisols	Humic Gley soils.
Yeates Hollow	Clayey-skeletal, montmorillonitic, frigid.	Typic Argixerolls	Mollisols	Brunizems.

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[1] The Richmond soils in the Richmond-Munk association, eroded, (REG2) are taxadjuncts to the Richmond series. They are very shallow and excessively drained, and they contain more ashy material than the defined range for the Richmond series.

zon). Gilgai microrelief, slickenslides, and wedge-shaped or parallelepiped structures are dominant characteristics of these soils.

Inceptisols are relatively young soils in which some rather definite horizons are beginning to form. These soils are generally moist and have a thin or light-colored A horizon or have an organic-matter accumulation of less than 1 percent in the upper 7 inches. They have formed a weak B2 horizon (cambic horizon) or a distinct horizon of carbonate accumulation (calcic horizon).

Aridisols are generally dry and have a light-colored or thin surface soil or contain less than 1 percent organic matter in the upper 7 inches. They have formed a strong lime horizon (calcic horizon) within a depth of 40 inches or a salt horizon (salic horizon) with more than 2 percent soluble salts within a depth of 30 inches.

Mollisols have a thick, dark-colored surface soil that contains 1 percent or more organic matter and 50 percent or more base saturation (mollic epipedon). About 95 percent of the acreage of soils in the Cache Area are Mollisols.

Alfisols have a B2t horizon (argillic or natric horizon) but lack a thick, dark-colored A1 horizon (mollic epipedon).

SUBORDER.—Orders are divided into suborders, primarily on the basis of the characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP.—Suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and properties. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans that interfere with growth of roots or movement of water. The properties used are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not

TABLE 7.—*Laboratory analyses*

[Dashes in columns indicate determinations were not made. The

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Airport silt loam.	0–4	0. 0	0. 1	0. 1	2. 1	10. 6	61. 6	25. 5	---------	12. 7
	4–11	0	. 1	. 1	2. 5	10. 5	57. 0	29. 8	---------	14. 9
	11–16	0	. 1	. 2	3. 5	12. 6	50. 9	32. 7	---------	14. 4
	16–25	. 1	. 1	. 3	5. 5	16. 2	43. 5	34. 3	---------	10. 5
	25–60	0	0	0	. 9	4. 9	72. 0	22. 2	---------	9. 7
Ant Flat loam.	0–7	. 3	. 7	1. 0	7. 1	21. 4	42. 6	26. 9	---------	12. 1
	7–11	. 2	. 7	1. 0	7. 2	20. 6	40. 5	29. 8	---------	11. 9
	11–18	. 2	1. 1	1. 4	5. 5	15. 4	37. 2	39. 2	2	14. 3
	18–32	. 6	1. 1	. 9	4. 2	10. 5	32. 4	50. 3	---------	18. 1
	32–40	. 3	. 9	. 9	4. 0	18. 7	43. 8	31. 4	13	12. 7
	40–48	. 3	. 8	. 8	4. 2	18. 4	45. 4	30. 1	4	13. 0
	48–60	. 5	1. 4	1. 4	6. 6	17. 4	39. 8	32. 9	11	14. 7
Bickmore gravelly silt loam.	0–2	0	. 1	. 1	. 4	3. 7	65. 9	29. 8	---------	16. 2
	2–16	. 1	. 1	. 1	. 4	4. 0	64. 5	30. 7	5	16. 1
	16–24	. 3	. 3	. 3	1. 0	4. 3	57. 1	36. 7	47	19. 4
	24–37	1. 0	2. 2	1. 8	3. 6	6. 1	55. 5	29. 8	67	14. 4
Blackrock gravelly loam.	0–8	7. 6	7. 7	3. 6	4. 9	7. 0	45. 1	24. 1	29	16. 2
	8–22	6. 2	7. 6	3. 6	4. 9	8. 2	41. 7	27. 8	21	16. 7
	22–39	5. 7	8. 0	4. 3	6. 0	8. 1	40. 8	27. 1	39	15. 6
	39–60	4. 2	5. 6	3. 6	6. 1	7. 0	37. 6	35. 9	11	17. 1
Cache silty clay.	0–4	. 1	. 1	. 1	. 1	1. 0	57. 6	40. 7	---------	14. 4
	4–16	0	. 1	. 1	. 2	. 7	43. 9	55. 0	---------	24. 2
	16–25	. 1	0	0	. 2	. 9	45. 5	53. 3	---------	24. 3
	25–30	0	. 1	. 1	. 3	1. 3	48. 1	50. 1	---------	25. 3
	30–39	0	0	0	. 1	. 8	46. 6	52. 5	---------	24. 5
	39–48	0	0	0	. 1	. 7	43. 7	55. 5	---------	25. 2
	48–60	. 1	0	0	. 2	1. 4	46. 3	52. 0	---------	[3]
	60–72	. 1	. 1	. 1	. 2	1. 1	48. 0	50. 4	---------	[3]

See footnotes at end of table.

shown separately in table 7, because it is the last word in the name of the subgroup.

SUBGROUP.—Great groups are divided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties integrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group.

FAMILY.—Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence.

SERIES.—The series consists of a group of soils that formed in a particular kind of parent material and have genetic horizons that, except for texture of the surface soil, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at the state, regional, and national levels of responsibility for soil classification results in a judgement that the new series should be established. Some of the soil series described in this publication have been established earlier. Most are new and in tentative status. All have been classified and correlated according to 1966 criteria.

Laboratory Analyses

Results of laboratory analyses of selected soil profiles are shown in table 7. The analyses were made by the Soil Conservation Service and the Utah State University Cooperative Soils Laboratory, Logan, Utah.

of selected soils

symbol > means less than; the symbol > means more than]

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1:5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations: Sodium	Extractable cations: Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
7.7	9.1	2.25	0.208	10.8	1.53	18.7	24.8	1.50	1.52	6	--------	43
8.0	9.7	1.27	.105	12.1	1.53	12.1	23.8	6.41	1.38	27	--------	44
9.2	10.3	.40	--------	--------	4.08	40.0	14.9	10.81	1.08	73	--------	46
9.7	10.4	.26	--------	--------	4.53	70.9	7.4	6.70	.50	91	--------	34
9.9	10.4	.16	--------	--------	3.54	59.0	8.9	8.40	.52	94	--------	47
6.2	7.0	4.29	.299	14.3	.83	--------	27.6	.13	1.04	--------	--------	64
6.3	7.2	2.44	.175	13.9	.96	--------	24.1	.18	1.09	--------	--------	53
6.6	8.0	1.22	--------	--------	1.29	6.7	24.7	.18	.49	--------	--------	51
7.1	8.6	.82	--------	--------	.89	15.0	33.3	.28	.27	--------	--------	70
7.1	8.5	.49	--------	--------	.56	23.8	23.0	.32	.27	--------	--------	51
7.1	8.3	.53	--------	--------	.57	22.3	21.0	.28	.26	--------	--------	50
7.1	8.2	.38	--------	--------	.46	28.7	22.8	.38	.24	--------	--------	56
6.5	7.3	5.61	.307	18.3	.79	--------	45.5	.19	2.30	--------	--------	66
6.6	7.3	3.71	.217	17.1	.78	--------	39.0	.26	1.99	--------	--------	59
6.7	7.4	3.16	--------	--------	.86	--------	39.5	.27	1.77	--------	--------	57
6.8	7.2	3.47	--------	--------	.76	30.0	29.6	.24	1.01	--------	--------	57
7.0	8.1	2.92	.247	11.8	.80	--------	40.9	.73	17.80	2	--------	51
6.9	8.5	1.68	.131	12.8	.95	--------	39.1	.99	18.10	2	--------	46
7.3	8.8	1.05	--------	--------	.72	--------	33.0	1.18	9.80	4	--------	47
7.8	9.2	.66	--------	--------	.73	13.7	28.2	1.12	3.47	4	--------	51
7.6	8.3	.60	.056	10.6	46.8	25.5	18.7	4.5	.96	24	--------	58
7.7	8.4	.33	.030	11.0	36.0	25.5	24.2	8.1	.46	33	--------	106
7.7	8.3	.31	.034	9.1	39.0	27.0	24.4	9.2	.12	38	--------	103
7.5	8.2	.46	--------	--------	42.6	23.8	28.0	9.0	.20	32	--------	98
7.5	8.2	.46	--------	--------	42.6	24.0	27.0	4.8	.21	18	--------	101
7.6	8.2	.46	--------	--------	42.6	22.4	26.3	9.7	.26	37	--------	100
7.6	8.2	.45	--------	--------	46.8	21.7	26.4	5.7	.20	21	--------	96
7.7	8.3	.43	--------	--------	39.0	21.5	26.0	7.7	.70	30	--------	95

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Cardon silty clay.	0–7	0. 1	0. 2	0. 7	3. 0	1. 5	40. 0	54. 5	---------	23. 7
	7–11	0	. 1	. 5	3. 2	1. 9	40. 4	53. 9	---------	23. 4
	11–22	0	. 1	. 4	2. 4	1. 5	40. 9	54. 7	---------	21. 1
	22–34	0	. 1	. 2	1. 3	. 9	43. 1	54. 4	---------	19. 2
	34–43	0	0	. 1	. 6	. 6	43. 9	54. 8	---------	18. 6
	43–62	0	0	0	. 2	. 8	47. 4	51. 5	---------	18. 5
Cluff silt loam.	0–4	3. 4	4. 5	3. 0	8. 5	5. 2	62. 1	13. 3	34. 7	7. 8
	4–9	4. 1	4. 4	3. 1	8. 8	16. 6	50. 0	13. 0	35. 0	6. 9
	9–24	4. 1	5. 0	3. 6	10. 0	20. 1	44. 8	12. 4	53. 2	5. 1
	24–31	4. 1	3. 9	3. 0	8. 9	16. 3	38. 4	25. 4	65. 6	8. 3
	[1] 31–44	4. 1	4. 4	3. 4	9. 2	15. 7	36. 0	27. 2	40. 8	9. 8
	44–62	4. 0	4. 2	3. 1	9. 2	17. 7	33. 9	27. 9	39. 2	10. 0
Collett silty clay loam.	0–7	. 2	. 3	. 4	1. 0	4. 2	59. 7	34. 2	---------	18. 5
	7–12	. 1	. 3	. 3	1. 2	4. 3	59. 7	34. 1	---------	18. 4
	12–17	. 1	. 1	. 2	1. 0	4. 2	58. 8	35. 6	---------	17. 7
	17–24	0	. 1	. 2	. 6	3. 6	56. 0	39. 5	---------	15. 3
	24–34	. 2	. 8	1. 0	1. 5	3. 7	52. 8	40. 0	---------	13. 5
	34–60	0	. 2	. 3	. 7	4. 2	58. 0	36. 6	---------	16. 9
Collinston loam.	0–8	. 2	1. 0	1. 6	9. 8	23. 5	46. 5	17. 4	---------	---------
	8–15	. 8	1. 5	2. 0	5. 2	14. 8	48. 9	26. 8	---------	---------
	15–25	. 2	2. 2	3. 7	8. 6	12. 1	43. 8	29. 4	---------	---------
	25–35	. 1	. 9	1. 4	3. 1	11. 5	59. 4	23. 6	---------	---------
	35–47	. 1	. 5	. 7	2. 0	14. 8	60. 8	21. 1	---------	---------
	47–60	. 1	. 3	. 6	1. 2	12. 8	63. 8	21. 2	---------	---------
Crookston loam.	0–6	. 1	. 8	2. 5	33. 5	11. 2	35. 8	16. 1	---------	11. 7
	6–14	. 2	1. 4	2. 6	35. 6	3. 3	38. 9	18. 0	---------	12. 4
	14–27	. 1	1. 0	2. 3	35. 2	5. 8	35. 0	20. 6	---------	14. 0
	27–48	. 3	2. 4	4. 5	39. 4	2. 4	32. 5	18. 5	---------	12. 9
	48–60	. 6	2. 4	4. 5	42. 1	3. 7	31. 3	15. 4	---------	11. 4
Crowshaw gravelly loam.	0–10	2. 0	2. 0	1. 5	5. 2	19. 9	49. 5	19. 9	18	10. 2
	10–16	3. 3	2. 5	1. 5	5. 5	19. 3	47. 6	20. 3	15	9. 7
	16–30	1. 8	2. 0	1. 6	6. 0	21. 2	44. 8	22. 6	25	9. 8
	30–60	2. 7	3. 1	2. 2	8. 0	22. 7	38. 9	22. 4	30	9. 8
Datwyler cobbly silty clay loam.	0–4	. 3	1. 1	1. 4	2. 3	13. 5	42. 3	39. 1	(2)	15. 9
	4–11	. 7	1. 8	1. 6	5. 5	9. 2	36. 6	44. 6	(2)	19. 3
	11–28	. 3	1. 4	2. 4	9. 8	6. 7	25. 6	53. 8	(2)	25. 8
	28–35	2. 4	10. 1	8. 1	16. 6	8. 7	24. 1	30. 0	(2)	12. 8
Elzinga silt loam.	0–8	. 5	. 6	. 9	4. 0	13. 0	61. 9	19. 1	(2)	20. 8
	8–22	. 8	1. 0	1. 0	4. 1	12. 1	61. 9	19. 1	(2)	17. 9
	22–26	1. 6	2. 6	2. 1	6. 5	15. 4	57. 7	14. 1	(2)	6. 7
	26–48	2. 2	4. 6	3. 2	8. 5	19. 0	51. 0	11. 5	(2)	5. 6
	48–62	. 5	2. 0	3. 8	14. 0	24. 7	42. 3	13. 7	(2)	5. 5
Goring silt loam.	0–3	. 1	1. 0	. 9	3. 2	15. 5	54. 0	25. 4	---------	12. 5
	3–7	. 2	. 8	. 8	2. 6	14. 7	54. 6	26. 3	---------	11. 8
	7–13	. 6	1. 5	1. 0	2. 6	12. 5	53. 0	28. 8	---------	12. 6
	13–22	. 2	. 9	. 8	2. 0	11. 8	46. 6	37. 7	---------	13. 5
	22–35	. 0	. 1	. 2	1. 4	16. 3	38. 6	43. 4	---------	16. 3
	35–60	. 1	. 6	. 7	2. 7	11. 9	44. 0	40. 0	---------	13. 6
Green Canyon gravelly loam.	0–9	3. 9	4. 1	2. 6	8. 2	15. 2	49. 4	16. 6	[2] 20	8. 8
	9–16	6. 8	5. 3	3. 4	10. 4	17. 3	40. 5	16. 3	[2] 20	7. 6
	16–23	10. 4	8. 3	6. 3	20. 6	21. 8	25. 7	6. 9	[2] 50	3. 3
	23–36	17. 8	19. 7	11. 5	19. 9	13. 8	12. 5	4. 8	[2] 70	2. 0
	36–42	17. 6	18. 3	11. 6	18. 7	14. 8	15. 0	4. 0	[2] 70	1. 9

See footnotes at end of table.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1:5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
7.6	8.3	2.50	0.207	12.1	0.9	5.5	41.0	0.4	1.60	1	--------	72
7.6	8.4	1.65	.142	11.6	.7	5.6	40.2	.4	1.24	1	--------	73
7.5	8.5	.78	.084	9.3	.6	18.8	32.0	.5	1.00	2	--------	72
7.8	8.6	.54	--------	--------	.8	29.9	27.2	.6	.85	2	--------	67
8.0	8.9	.37	--------	--------	.9	35.6	25.6	.6	.80	3	--------	73
8.0	9.0	.28	--------	--------	.9	35.9	23.0	.7	.77	3	--------	74
6.0	6.2	2.34	.126	18.6	.91	--------	16.8	.13	.84	--------	58	43
6.1	6.5	1.28	.088	14.5	.62	--------	14.2	.15	.95	--------	60	37
5.9	6.6	.56	--------	--------	.43	--------	8.8	.13	.63	--------	58	27
5.4	6.3	.31	--------	--------	.27	--------	14.1	.17	.69	--------	72	30
5.2	6.3	.35	--------	--------	.17	--------	17.0	.17	.79	--------	72	33
5.2	5.9	.40	--------	--------	.22	--------	17.0	.17	.79	--------	71	32
7.6	8.2	1.88	.186	10.1	1.48	4.9	29.3	.71	3.29	2	--------	56
7.8	8.5	1.31	.139	9.4	1.18	2.8	27.6	.69	1.47	2	--------	54
7.9	8.9	.81	.089	9.1	1.40	12.2	24.3	.85	1.43	3	--------	54
8.4	9.4	.52	--------	--------	1.22	22.3	12.5	.51	.81	4	--------	54
8.4	9.3	.31	--------	--------	.83	60.3	15.0	.56	.70	4	--------	63
8.1	9.2	.28	--------	--------	.56	35.6	18.0	.63	1.28	4	--------	58
7.6	8.6	2.24	--------	--------	.94	7.2	27.8	--------	--------	--------	--------	52
7.5	8.6	1.52	--------	--------	.85	4.2	32.9	--------	--------	--------	--------	50
7.6	9.0	.88	--------	--------	1.49	56.8	18.1	--------	--------	--------	--------	52
8.1	9.6	--------	--------	--------	.85	32.7	19.5	--------	--------	--------	--------	52
8.2	9.6	--------	--------	--------	.94	29.5	19.6	--------	--------	--------	--------	52
8.3	9.6	--------	--------	--------	1.06	28.3	19.9	--------	--------	--------	--------	56
7.7	8.8	1.67	.119	14.0	.69	--------	25.2	.4	5.0	2	--------	42
7.8	8.4	1.74	.122	14.3	.67	--------	26.9	.5	5.0	2	--------	49
7.5	8.7	1.02	.101	10.1	.70	--------	26.0	.7	4.9	3	--------	52
7.5	9.3	.49	--------	--------	.50	26.4	17.6	.5	4.2	3	--------	43
7.6	8.9	.41	--------	--------	.50	29.8	16.4	.5	5.2	3	--------	48
6.3	6.9	2.30	.163	14.1	.5	--------	23.9	.4	.7	--------	81	40
6.3	6.9	1.30	.103	12.6	.3	--------	19.6	.3	.6	--------	82	39
6.2	7.1	.74	.073	10.1	.3	--------	16.7	.3	.6	--------	83	39
6.5	7.3	--------	--------	--------	.2	--------	16.7	.3	.4	--------	87	40
7.1	8.0	1.30	.118	11.0	.37	--------	30.7	.15	1.71	<1	--------	45
7.1	8.0	1.37	.116	11.8	.24	1.2	24.2	.21	1.16	<1	--------	52
7.0	7.9	1.46	--------	--------	.32	--------	43.9	.19	1.11	<1	--------	67
7.6	8.8	1.04	--------	--------	.42	63.6	14.3	.13	.23	<1	--------	46
6.4	7.4	7.28	.518	14.1	.28	--------	43.1	.15	1.59	--------	69	52
6.3	7.3	5.13	.400	12.8	.25	--------	37.0	.13	1.27	--------	66	70
6.3	7.1	.75	--------	--------	.24	--------	12.6	.18	.22	--------	71	36
6.3	7.0	.41	--------	--------	.29	--------	10.1	.11	.19	--------	73	28
6.4	7.1	.48	--------	--------	.28	--------	9.6	.20	.19	--------	74	27
6.5	7.0	3.46	.242	14.3	.80	--------	28.2	.08	1.85	--------	69	47
6.4	7.3	1.99	.162	12.3	.56	--------	25.1	.11	1.81	--------	71	42
6.3	7.3	1.28	--------	--------	.48	--------	23.5	.13	1.53	--------	72	45
6.3	7.3	.84	--------	--------	.33	--------	24.5	.19	1.12	--------	72	44
6.1	7.3	.48	--------	--------	.16	--------	29.2	.22	.47	--------	82	47
6.3	7.4	.20	--------	--------	.14	--------	21.9	.21	.36	--------	88	44
7.9	8.8	1.77	.168	10.5	.66	21.2	18.9	.29	.60	2	--------	33
7.9	8.9	.98	.102	9.6	.69	24.4	17.5	.30	.45	2	--------	30
8.0	9.0	.56	--------	--------	.63	39.7	6.2	.32	.27	5	--------	21
8.2	9.3	.26	--------	--------	.66	44.1	3.3	.30	.27	9	--------	18
8.0	9.4	.23	--------	--------	.76	47.3	2.9	.29	.24	10	--------	16

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Greenson loam.	0–7	0.1	0.3	1.3	6.6	24.5	45.2	22.0	---------	11.1
	7–16	0	.2	1.6	7.8	24.5	43.3	22.6	---------	6.7
	16–23	0	.2	2.1	10.8	28.6	39.1	19.2	---------	9.8
	23–27	0	.2	1.9	12.2	28.2	33.0	24.5	---------	11.8
	27–39	0	.3	2.3	13.4	30.1	33.5	20.4	---------	9.9
	39–51	0	.3	1.9	12.5	32.7	37.8	14.8	---------	6.9
	51–63	0	.2	.7	6.3	35.1	47.3	10.4	---------	8.4
	63–72	0	.2	.3	2.0	21.5	66.0	10.4	---------	6.5
Hendricks silt loam.	0–5	.3	1.3	1.6	2.5	8.4	62.2	23.7	---------	11.0
	5–15	.4	1.3	1.5	2.3	8.3	61.6	24.6	---------	11.9
	15–27	.3	1.0	1.2	2.1	7.3	57.7	30.4	---------	13.1
	27–48	.9	2.5	2.6	3.8	8.7	52.7	28.8	---------	12.6
	48–66	.7	2.0	2.4	4.5	8.6	44.9	36.9	---------	17.9
Hiibner gravelly clay loam.	0–3	2.4	2.3	1.5	4.6	23.3	38.1	27.8	24	13.0
	3–6	1.7	2.1	1.4	4.0	19.6	33.9	37.3	28	15.1
	6–12	4.8	4.0	2.0	3.8	14.5	26.1	44.8	48	18.8
	12–27	5.9	6.7	3.7	6.5	12.3	15.7	49.2	50	21.9
	27–60	11.7	11.5	4.4	5.8	8.8	16.2	41.6	59	19.0
Hillfield silt loam.	0–8	0	.5	.5	1.6	19.4	58.4	19.6	---------	8.9
	8–15	0	.5	.5	1.2	29.6	53.7	14.5	---------	7.2
	15–23	0	.6	.4	1.2	32.7	49.3	15.8	---------	7.3
	23–40	0	.4	.3	1.7	47.6	38.8	11.2	---------	5.0
	40–60	0	.4	.2	1.8	51.9	37.3	8.4	---------	4.4
Hoskin cobbly loam.	0–7	1.9	4.9	3.8	11.5	17.7	44.1	16.1	(2)	7.7
	7–16	1.4	4.1	3.5	11.1	16.9	42.9	20.1	(2)	9.6
	16–28	1.2	4.2	3.5	11.2	18.5	41.0	20.4	(2)	9.5
Hyrum gravelly loam.	0–8	4.3	2.4	1.7	5.6	22.5	43.5	20.0	[2] 25	13.1
	8–17	5.9	2.9	1.6	5.3	21.7	35.6	27.0	[2] 12	11.7
	17–31	4.6	2.3	1.7	5.8	23.8	32.6	29.2	[2] 20	11.8
	31–42	5.5	2.9	1.8	5.3	17.5	34.9	32.1	[2] 17	13.8
	42–60	5.4	2.1	1.7	8.6	32.1	29.1	21.0	[2] 11	10.3
Jordan silty clay loam.	0–5	.6	.4	.3	.9	3.4	60.7	33.7	---------	11.2
	5–10	0	.1	.1	.4	1.3	40.8	57.3	---------	17.6
	10–21	0	0	0	.1	1.7	50.1	48.1	---------	20.9
	21–42	0	0	.1	.4	7.3	58.8	33.4	---------	19.1
	42–68	0	0	0	.2	1.8	52.5	45.5	---------	18.3
Kidman fine sandy loam.	0–8	0	.6	6.2	36.7	21.6	24.8	10.1	---------	---------
	8–12	0	.6	5.6	34.8	23.5	23.5	12.0	---------	---------
	12–20	0	.4	4.2	36.3	27.5	19.7	11.9	---------	---------
	20–27	0	.4	3.5	39.4	33.9	12.5	10.3	---------	---------
	27–43	0	.3	4.3	43.5	34.6	11.8	5.5	---------	---------
	43–60	.1	1.8	19.2	68.5	6.6	2.6	1.2	---------	---------
Kirkham silt loam.	0–9	.0	.3	.4	4.9	12.8	63.7	17.9	---------	13.4
	9–15	.1	.1	.1	1.0	6.2	62.1	30.4	---------	16.3
	15–23	.0	.1	.1	.6	4.3	66.0	28.9	---------	16.1
	23–60	.0	.1	.3	3.3	5.6	66.5	24.2	---------	13.3
Lakewin gravelly coarse sandy loam.	0–7	7.6	30.0	19.2	4.3	3.5	24.4	11.0	23	6.4
	7–18	6.9	30.6	20.5	4.5	3.7	21.6	12.2	19	6.1
	18–27	5.7	40.1	28.4	4.6	2.6	11.4	7.2	34	4.3
	27–34	9.2	36.0	25.9	7.2	4.2	17.5	0	35+	3.6
	34–60	8.6	31.2	28.8	15.1	6.2	10.1	0	68	2.8

See footnotes at end of table.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1: 5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
7. 7	8. 2	1. 81	0. 154	11. 8	0. 99	1. 1	24. 1	0. 90	0. 83	4	--------	45
7. 7	8. 4	1. 01	. 117	8. 6	. 77	2. 0	23. 3	. 98	. 73	4	--------	47
7. 9	8. 7	. 58	. 076	7. 6	. 93	2. 5	19. 1	1. 14	. 49	6	--------	45
8. 1	9. 1	. 48	. 061	7. 8	. 73	35. 1	13. 3	1. 06	. 30	8	--------	46
8. 0	9. 1	. 36	--------	--------	. 72	33. 0	10. 6	. 97	. 35	9	--------	38
8. 1	9. 2	. 23	--------	--------	. 78	31. 3	10. 8	1. 05	. 46	10	--------	30
8. 2	9. 2	. 22	--------	--------	. 67	26. 7	11. 5	. 92	. 51	8	--------	33
8. 2	9. 1	. 10	--------	--------	. 50	25. 8	12. 8	1. 05	. 59	8	--------	35
6. 8	7. 5	2. 26	. 199	11. 4	1. 0	----------	22. 2	. 25	1. 69	1	--------	39
6. 4	7. 3	1. 74	. 161	10. 8	. 38	----------	21. 6	. 36	. 95	2	--------	38
6. 2	7. 5	. 83	. 098	8. 5	. 35	----------	18. 4	. 35	. 89	2	--------	36
6. 4	7. 3	. 45	--------	--------	. 37	----------	17. 6	. 42	. 84	2	--------	38
6. 3	7. 3	. 32	--------	--------	. 39	----------	26. 2	. 37	. 71	1	--------	49
6. 9	8. 3	3. 63	. 267	13. 6	1. 40	----------	23. 8	. 29	2. 04	--------	86	54
6. 6	7. 7	2. 56	. 192	13. 3	1. 11	----------	26. 8	. 35	1. 45	--------	82	51
6. 2	7. 7	1. 75	. 134	13. 0	1. 09	----------	30. 7	. 31	. 95	--------	85	55
6. 1	7. 7	. 52	--------	--------	. 70	----------	34. 5	. 33	. 71	--------	83	64
6. 2	7. 7	1. 00	--------	--------	. 46	----------	27. 7	. 37	. 60	--------	86	49
7. 4	8. 5	. 79	. 090	8. 8	. 57	22. 5	14. 5	. 18	. 75	2	--------	40
7. 5	8. 6	. 29	. 038	7. 6	. 44	27. 8	12. 8	. 35	. 46	3	--------	39
7. 6	8. 0	. 19	. 033	5. 8	. 44	27. 5	12. 1	. 33	. 46	3	--------	37
7. 8	8. 5	. 06	--------	--------	. 45	22. 5	9. 22	. 31	. 36	3	--------	33
7. 8	8. 6	. 08	--------	--------	. 35	22. 6	7. 32	. 32	. 34	4	--------	31
6. 8	7. 5	2. 30	. 167	13. 8	1. 30	----------	18. 8	. 14	. 89	--------	71	36
7. 0	7. 6	1. 92	. 162	11. 9	. 32	----------	21. 9	. 19	. 43	--------	74	41
6. 8	7. 6	1. 77	--------	--------	. 41	. 5	22. 1	. 18	. 38	--------	81	41
6. 9	7. 9	3. 80	. 277	13. 7	1. 09	----------	29. 8	. 2	2. 07	--------	87	50
6. 8	7. 8	2. 33	. 186	12. 5	. 74	----------	27. 0	. 2	1. 18	--------	89	42
7. 1	8. 0	1. 38	. 128	10. 8	. 65	----------	25. 7	. 3	. 76	--------	--------	44
7. 1	7. 8	. 83	. 088	9. 4	. 38	----------	28. 7	. 3	. 85	--------	--------	49
7. 4	7. 8	. 42	. 060	7. 0	. 48	----------	21. 3	. 2	. 63	--------	--------	39
8. 1	8. 8	1. 16	. 118	9. 8	9. 4	1. 3	20. 1	5. 3	----------	26	--------	54
8. 2	8. 6	. 77	. 089	8. 7	12. 4	11. 0	26. 5	10. 4	----------	39	--------	73
8. 7	9. 2	--------	--------	--------	22. 5	30. 3	21. 1	9. 8	----------	47	--------	91
8. 8	9. 2	--------	--------	--------	12. 4	20. 6	19. 1	12. 2	----------	64	--------	89
8. 8	9. 3	--------	--------	--------	6. 9	23. 0	22. 5	13. 8	----------	61	--------	108
7. 5	8. 3	. 72	--------	--------	1. 13	----------	8. 8	. 29	. 71	3	--------	30
7. 5	8. 1	. 43	--------	--------	. 77	----------	8. 3	. 30	. 57	4	--------	29
7. 4	8. 3	. 31	--------	--------	1. 49	----------	7. 9	. 29	. 46	4	--------	28
7. 5	8. 2	. 24	--------	--------	. 72	----------	6. 6	. 30	. 35	5	--------	27
7. 9	9. 0	--------	--------	--------	. 60	8. 9	4. 4	. 24	. 30	5	--------	26
8. 3	9. 2	--------	--------	--------	. 43	7. 2	1. 8	. 37	. 14	21	--------	30
8. 0	9. 1	2. 02	. 177	11. 4	. 67	27. 2	23. 6	. 59	. 76	3	--------	55
7. 7	8. 7	1. 75	. 173	10. 1	. 76	19. 5	27. 6	. 67	. 62	2	--------	67
7. 6	8. 7	1. 46	--------	--------	. 95	17. 9	27. 8	. 49	. 57	2	--------	64
7. 7	8. 8	. 62	--------	--------	. 95	22. 4	21. 6	. 92	. 54	4	--------	57
7. 2	8. 3	1. 08	. 097	11. 1	. 65	----------	13. 9	. 2	. 93	1	--------	23
7. 4	8. 2	. 66	. 069	9. 6	. 51	----------	13. 6	. 2	. 74	1	--------	23
7. 6	7. 8	. 38	. 041	9. 3	. 71	----------	8. 4	. 1	. 41	2	--------	21
7. 8	8. 4	. 30	. 040	7. 5	. 57	----------	8. 6	. 2	. 33	2	--------	20
8. 0	8. 6	. 16	. 020	8. 0	. 36	18. 1	5. 2	. 2	. 28	4	--------	24

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Lasil silty clay loam.	0–5	0	0. 1	0	0. 2	1. 6	68. 8	29. 3	---------	12. 8
	5–13	. 1	. 6	0	. 7	3. 5	62. 9	32. 2	---------	13. 4
	13–23	0	. 2	0	. 5	3. 7	60. 1	35. 5	---------	14. 8
	23–32	0	. 2	0	. 4	3. 5	59. 0	36. 9	---------	15. 5
	32–39	0	. 2	0	. 4	3. 2	57. 4	38. 8	---------	17. 2
	39–60	0	. 1	. 1	. 3	5. 0	59. 3	35. 2	---------	16. 7
Leatham silt loam.	0–4	. 7	. 7	1. 0	6. 9	14. 4	45. 7	30. 6	---------	15. 1
	4–10	. 4	. 6	. 9	6. 6	14. 1	44. 3	33. 1	---------	17. 2
	10–15	. 1	. 3	. 4	3. 4	8. 1	52. 8	34. 9	---------	19. 5
	15–25	. 2	. 2	. 3	2. 3	15. 8	56. 7	24. 5	---------	13. 2
	25–39	. 0	. 1	. 5	4. 0	15. 2	51. 7	28. 5	---------	14. 3
Lewiston fine sandy loam.	0–10	0	1. 2	10. 4	48. 4	14. 5	18. 2	7. 3	---------	4. 9
	10–13	. 1	1. 0	8. 9	46. 5	16. 6	9. 7	17. 2	---------	6. 1
	13–22	. 1	. 9	7. 3	36. 0	16. 0	19. 7	20. 0	---------	8. 1
	22–32	. 1	. 8	7. 0	40. 3	21. 3	13. 4	17. 1	---------	5. 6
	32–60	. 1	. 7	5. 7	58. 7	18. 5	9. 9	6. 4	---------	6. 5
Logan silty clay loam.	0–13	---------	---------	---------	---------	---------	---------	---------	---------	25. 8
	13–26	---------	---------	---------	---------	---------	---------	---------	---------	17. 5
	26–45	---------	---------	---------	---------	---------	---------	---------	---------	21. 1
	45–60	---------	---------	---------	---------	---------	---------	---------	---------	22. 7
Lucky Star gravelly silt loam.	0–5	2. 1	3. 4	2. 5	5. 3	14. 0	58. 5	14. 2	(2)	22. 2
	5–13	2. 0	1. 9	2. 4	6. 4	14. 1	58. 7	14. 5	(2)	15. 9
	13–26	2. 7	5. 5	4. 0	8. 9	21. 9	49. 9	7. 1	(2)	4. 0
	26–35	5. 4	8. 9	6. 4	15. 8	25. 8	32. 2	5. 5	(2)	3. 9
	35–55	5. 5	10. 6	6. 2	16. 7	25. 8	30. 1	5. 1	(2)	3. 9
	55–70	3. 1	4. 7	3. 2	7. 4	20. 8	41. 6	19. 2	(2)	9. 2
	70–72	2. 8	5. 7	3. 8	9. 5	24. 0	41. 0	13. 2	(2)	6. 3
Maughan silt loam.	0–8	1. 1	1. 3	. 8	2. 3	9. 0	62. 9	22. 6	---------	24. 0
	8–25	. 4	. 8	. 8	1. 9	9. 2	62. 3	24. 6	---------	16. 9
	25–32	. 8	1. 6	1. 6	4. 4	6. 5	64. 2	20. 9	---------	9. 7
	32–38	1. 3	5. 4	3. 7	6. 6	11. 1	32. 8	39. 0	---------	17. 5
	38–50	1. 4	3. 8	3. 4	5. 1	6. 4	26. 0	53. 9	---------	24. 2
	50–66	1. 9	4. 5	3. 9	5. 2	8. 6	32. 3	43. 6	---------	20. 3
McMurdie silt loam.	0–7	. 3	1. 0	1. 5	1. 3	7. 6	63. 3	25. 0	---------	12. 3
	7–14	. 1	. 8	1. 5	1. 1	8. 1	57. 4	31. 0	---------	17. 8
	14–25	0	. 2	. 3	. 6	4. 6	47. 3	47. 0	---------	27. 7
	25–33	. 1	. 2	. 3	. 5	3. 8	48. 5	46. 6	---------	23. 7
	33–43	0	. 2	. 5	1. 1	10. 4	60. 2	27. 6	---------	17. 2
	43–50	0	. 8	1. 7	22. 1	14. 9	42. 3	18. 2	---------	10. 4
	50–58	. 2	17. 6	30. 3	9. 5	7. 6	22. 7	12. 1	---------	7. 4
Mendon silt loam.	0–7	. 2	1. 4	2. 5	2. 7	8. 9	61. 1	23. 2	---------	11. 4
	7–24	. 1	. 9	1. 7	10. 3	8. 0	43. 2	35. 8	---------	17. 6
	24–28	0	1. 1	2. 0	14. 9	4. 4	44. 0	33. 6	---------	ins.
	28–34	. 4	3. 1	5. 5	31. 0	7. 6	34. 4	18. 0	---------	10. 9
	34–40	. 5	2. 9	5. 1	32. 5	9. 0	32. 7	17. 3	---------	9. 4
	40–48	. 4	1. 7	1. 9	26. 8	13. 5	37. 2	18. 5	---------	10. 4
Millville silt loam.	0–6	. 3	. 7	1. 1	7. 6	19. 4	54. 6	16. 3	---------	8. 7
	6–12	. 2	. 4	. 9	6. 9	18. 3	57. 8	15. 5	---------	8. 8
	12–24	0	. 1	. 3	4. 1	16. 6	63. 2	15. 7	---------	10. 5
	24–35	. 1	. 1	. 3	5. 0	18. 6	60. 3	15. 6	---------	7. 1
	35–49	. 1	. 1	. 3	4. 7	19. 4	59. 9	15. 5	---------	7. 9
	49–65	. 1	. 3	. 5	6. 8	22. 5	60. 7	9. 1	---------	---------

See footnotes at end of table.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1:5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
7.3	8.3	2.13	0.188	11.3	1.7	1.1	24.2	0.7	2.69	3	--------	49
8.0	8.9	1.12	.106	10.6	1.8	1.8	23.1	2.2	2.22	10	--------	47
7.9	8.8	.70	.069	10.1	7.3	2.8	23.0	3.2	1.76	23	--------	51
8.1	9.0	.63	--------	--------	9.8	5.6	21.8	7.9	1.28	36	--------	54
8.2	9.0	.48	--------	--------	8.5	11.3	21.3	10.7	1.00	50	--------	61
8.4	8.8	.16	--------	--------	12.9	25.5	20.6	14.2	.51	69	--------	73
7.3	8.6	2.21	.209	10.6	.59	31.4	26.8	.20	1.22	--------	--------	52
7.2	8.7	1.91	.185	10.3	.95	32.8	29.3	.14	1.02	--------	--------	54
7.4	8.8	1.67	--------	--------	.64	49.8	25.9	.09	.67	--------	--------	60
7.5	8.9	.71	--------	--------	.43	53.3	16.7	.18	.35	--------	--------	48
7.6	9.2	.40	--------	--------	.44	60.2	18.1	.16	.35	--------	--------	54
7.8	9.1	.60	.062	9.7	1.85	2.0	9.7	.7	.97	7	--------	25
8.0	9.1	.42	.053	7.9	1.40	2.7	9.5	.7	.74	7	--------	26
8.4	9.5	.39	.044	8.9	1.36	28.7	6.8	.9	.47	13	--------	27
8.7	9.7	.16	.019	8.4	1.61	18.3	5.3	.8	.39	15	--------	28
8.6	9.6	.08	.014	5.7	1.85	13.4	3.3	.6	.33	17	--------	25
7.7	8.7	3.82	.337	11.3	.96	12.2	5.0	.90	.05	2	--------	79
8.0	8.9	.84	.065	12.9	.50	44.7	18.2	.52	.03	3	--------	74
7.9	8.8	.27	--------	--------	.38	33.5	21.6	.53	.03	2	--------	83
8.0	8.9	.22	--------	--------	.41	23.6	27.5	.73	.04	3	--------	105
6.3	7.3	8.48	.553	15.3	.50	----------	52.6	.15	1.59	--------	75	86
6.2	7.2	5.18	.372	13.9	.41	----------	38.2	.11	1.18	--------	69	69
6.0	7.0	.33	--------	--------	.19	----------	6.80	.07	.23	--------	79	22
6.1	7.0	.16	--------	--------	.15	----------	5.03	.06	.21	--------	68	21
6.0	6.8	.23	--------	--------	.15	----------	5.71	.09	.24	--------	65	20
6.1	6.5	.19	--------	--------	.23	----------	13.6	.11	.49	--------	73	34
6.1	6.5	.16	--------	--------	.25	----------	9.6	.11	.35	--------	63	26
6.6	7.4	6.94	.528	13.1	.43	----------	46.6	.12	1.61	--------	68	81
6.2	7.2	4.08	.341	12.0	.27	----------	36.9	.17	1.39	--------	65	61
6.3	6.9	.81	--------	--------	.61	----------	16.9	.12	.51	--------	79	37
6.0	6.8	.83	--------	--------	.24	----------	29.4	.14	.73	--------	73	50
6.3	7.1	.94	--------	--------	.26	----------	40.3	.29	.60	--------	74	66
7.0	8.0	.82	--------	--------	.28	----------	33.4	.20	.48	--------	--------	66
7.2	8.1	1.86	.145	12.8	.44	1.2	31.7	.2	1.40	1	--------	43
7.1	8.0	1.51	.118	12.8	.46	----------	26.8	.3	1.11	1	--------	44
6.8	8.0	.72	.068	10.6	.35	----------	34.2	.3	1.14	1	--------	65
6.7	8.0	.69	.061	11.3	.37	----------	38.0	.3	.86	1	--------	68
7.2	8.4	.45	.052	8.7	.44	25.9	25.8	.4	.58	2	--------	53
7.4	8.6	.27	.033	8.2	.53	31.4	17.9	.4	.44	2	--------	39
7.5	8.7	.16	.014	11.4	.56	27.8	12.3	.3	.40	3	--------	30
7.3	8.4	1.86	.135	13.8	.44	----------	23.3	.2	2.6	1	--------	42
7.1	8.1	1.12	.110	10.2	.82	----------	27.2	.3	3.8	1	--------	57
7.6	8.5	(3)	--------	--------	.66	36.5	20.3	.3	2.5	2	--------	53
7.5	8.8	.42	--------	--------	.48	42.7	12.2	.4	1.2	3	--------	44
7.8	9.1	.36	--------	--------	.33	35.3	12.2	.4	.9	3	--------	39
7.7	9.0	.19	--------	--------	.44	16.9	15.3	.4	.9	2	--------	42
7.9	8.4	1.36	.129	10.5	.52	43.6	13.9	.94	.78	7	--------	35
7.9	8.6	1.27	.121	10.5	.45	43.9	14.0	.85	.72	6	--------	36
8.0	8.9	.72	.076	9.5	.35	49.9	11.8	.97	.59	8	--------	37
8.0	8.9	.45	.053	8.5	.34	63.0	8.6	.96	.45	11	--------	34
8.1	9.0	.38	--------	--------	.37	70.4	6.7	.71	.30	10	--------	32
8.2	9.1	.28	--------	--------	.34	73.0	6.0	.79	.29	13	--------	28

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Mult silt loam.	0–4	0. 8	4. 1	2. 7	4. 6	5. 9	53. 0	28. 9	---------	14. 3
	4–14	. 4	3. 5	3. 0	5. 4	6. 7	53. 1	27. 9	---------	12. 5
	14–22	. 8	3. 7	2. 5	4. 0	4. 8	53. 3	30. 9	---------	12. 9
	22–24	. 3	2. 1	1. 7	3. 6	4. 7	52. 5	35. 1	---------	14. 4
Nebeker silt loam.	0–8	. 6	1. 0	1. 0	2. 1	11. 9	63. 1	20. 3	15	9. 2
	8–14	. 8	. 9	1. 0	2. 0	10. 6	58. 6	26. 1	13	11. 3
	14–26	. 6	. 8	1. 0	1. 9	9. 8	55. 8	30. 1	8	12. 3
	26–38	. 8	1. 4	1. 9	4. 3	8. 9	27. 5	55. 2	9	23. 9
	38–48	1. 4	2. 7	2. 7	5. 8	10. 4	20. 4	56. 6	11	23. 3
	48–55	2. 2	2. 7	2. 4	7. 5	16. 5	28. 0	40. 7	11	18. 5
	55–70	2. 2	3. 1	2. 7	9. 5	19. 8	33. 9	28. 8	12	12. 3
Nibley silty clay loam.	0–7	. 1	. 2	. 5	2. 7	3. 9	53. 0	39. 6	---------	16. 1
	7–13	0	. 2	. 4	1. 8	3. 2	54. 8	39. 6	---------	16. 9
	13–20	0	. 1	. 3	1. 2	1. 7	44. 2	52. 5	---------	20. 3
	20–32	0	. 1	. 1	. 5	1. 2	53. 2	44. 9	---------	16. 4
	32–43	0	. 1	. 1	. 2	1. 3	52. 0	46. 3	---------	17. 8
	43–60	0	. 1	. 1	. 3	2. 5	57. 7	39. 3	---------	19. 5
Obray silty clay.	0–7	. 1	. 2	. 2	. 6	6. 8	44. 0	48. 1	---------	21. 1
	7–22	0	. 2	. 2	. 6	6. 6	43. 7	48. 7	---------	23. 2
	22–32	. 2	. 3	. 3	. 6	6. 3	44. 5	47. 8	---------	23. 3
	32–39	. 1	. 3	. 3	. 6	6. 2	47. 4	45. 1	---------	23. 8
	39–52	. 2	. 5	. 5	. 9	5. 5	49. 0	43. 4	---------	24. 1
	52–60	. 6	2. 2	2. 1	3. 0	7. 5	47. 4	37. 2	---------	21. 6
Parleys silt loam.	0–8	. 2	. 3	. 2	2. 6	23. 8	52. 2	20. 7	---------	9. 0
	8–12	0	. 1	. 2	4. 0	24. 4	45. 9	25. 4	---------	11. 7
	12–19	0	. 1	. 2	4. 2	25. 5	41. 6	28. 4	---------	12. 9
	19–31	. 2	. 1	. 2	2. 0	18. 8	48. 0	30. 7	---------	14. 2
	31–36	0	. 1	. 1	. 9	18. 0	61. 7	19. 2	---------	9. 5
	36–52	0	. 6	1. 1	3. 2	27. 1	55. 1	12. 9	---------	7. 3
	52–68	. 1	1. 0	1. 2	3. 1	24. 6	58. 7	11. 3	---------	6. 3
Preston fine sand.	0–6	. 8	6. 6	22. 0	51. 4	7. 5	7. 3	5. 2	---------	2. 4
	6–15	1. 6	6. 8	21. 9	51. 2	6. 4	3. 8	8. 3	---------	2. 3
	15–26	2. 0	2. 1	21. 9	52. 0	7. 5	8. 1	6. 4	---------	2. 5
	26–38	1. 1	3. 6	16. 6	61. 3	10. 6	1. 3	5. 5	---------	1. 8
	38–50	. 4	3. 9	17. 5	61. 7	11. 4	3. 5	1. 6	---------	1. 5
	50–64	. 2	2. 1	14. 0	60. 5	15. 8	5. 8	1. 6	---------	1. 5
Provo gravelly loam.	2–0	. 6	1. 3	1. 5	4. 1	8. 0	57. 5	27. 0	---------	59. 8
	0–7	2. 8	4. 9	3. 1	5. 2	11. 4	51. 9	20. 7	30	16. 0
	7–13	2. 4	4. 9	3. 3	5. 8	13. 1	48. 2	22. 3	51	13. 8
	13–19	4. 0	5. 9	3. 8	6. 9	15. 6	42. 2	21. 6	78	11. 2
	19–27	3. 3	6. 4	4. 8	8. 6	18. 8	40. 7	17. 4	87	8. 3
	27–60	8. 6	12. 6	8. 5	10. 6	16. 4	32. 8	10. 5	93	(3)
Quinney silt loam.	0–8	0	17. 7	3. 0	2. 0	7. 8	58. 2	11. 3	---------	7. 0
	8–12	0	0	. 2	9. 4	32. 9	42. 2	15. 3	---------	10. 1
	12–18	0	0	. 2	9. 5	33. 4	37. 8	19. 1	---------	11. 2
	18–26	0	0	. 2	7. 6	26. 4	40. 6	25. 2	---------	11. 2
	26–39	0	. 1	. 2	8. 0	30. 0	39. 8	21. 9	---------	10. 0
	39–60	0	0	. 1	. 6	2. 9	56. 2	40. 2	---------	19. 5
Richmond very stony loam.	0–8	5. 0	5. 6	3. 2	9. 9	19. 0	46. 6	10. 7	[4] 20	6. 0
	8–13	5. 1	5. 8	3. 2	8. 6	17. 4	46. 6	13. 3	[4] 50	6. 6
	13–18	6. 9	7. 9	4. 4	9. 0	15. 0	45. 8	11. 0	[4] 80	6. 2
Roshe Springs silt loam.	0–8	. 6	1. 8	7. 7	6. 4	12. 3	57. 5	18. 7	---------	---------
	8–14	. 4	. 9	1. 9	7. 5	11. 9	59. 7	17. 7	---------	---------
	14–23	. 0	. 1	. 2	1. 2	5. 9	73. 6	19. 0	---------	---------
	23–35	. 0	. 1	. 2	. 5	2. 3	88. 8	8. 1	---------	---------
	35–50	. 0	. 1	. 1	. 4	7. 5	70. 5	21. 4	---------	---------

See footnotes at end of table.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1: 5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
6. 2	7. 1	3. 80	0. 267	14. 2	0. 57	----------	30. 7	0. 21	1. 63	--------	74	56
5. 9	6. 9	2. 03	. 137	14. 8	. 38	----------	24. 2	. 15	1. 42	--------	74	46
6. 0	7. 0	. 69	--------	--------	. 32	----------	22. 4	. 18	1. 39	--------	81	50
6. 4	7. 4	1. 04	--------	--------	. 56	----------	24. 6	. 17	1. 33	--------	85	51
6. 1	6. 9	1. 73	. 140	12. 4	. 40	----------	21. 5	. 28	1. 24	--------	78	37
6. 0	6. 6	. 92	. 106	8. 7	. 40	----------	19. 2	. 31	. 92	--------	81	40
6. 3	7. 0	. 56	--------	--------	. 30	----------	20. 6	. 31	. 65	--------	81	41
6. 5	7. 5	. 59	--------	--------	. 70	----------	36. 6	. 52	. 83	--------	88	67
6. 8	7. 5	. 54	--------	--------	. 48	----------	44. 7	. 66	. 92	--------	89	72
7. 3	8. 0	. 40	--------	--------	. 80	----------	29. 4	. 55	. 76	--------	--------	58
7. 6	8. 3	. 27	--------	--------	1. 04	2. 7	22. 0	. 58	. 62	--------	--------	44
7. 6	8. 7	1. 59	. 154	10. 3	. 85	----------	29. 3	. 45	1. 49	2	--------	49
7. 5	8. 7	1. 54	. 149	10. 3	. 51	----------	28. 5	. 36	1. 39	1	--------	51
7. 7	9. 0	. 69	. 080	8. 6	. 60	10. 6	28. 2	. 44	. 98	2	--------	58
8. 0	9. 3	. 44	--------	--------	. 83	39. 7	21. 6	. 53	. 55	2	--------	62
8. 6	9. 6	. 24	--------	--------	. 59	47. 7	18. 7	. 53	. 82	3	--------	67
8. 3	9. 7	. 13	--------	--------	. 61	33. 9	21. 3	. 61	1. 26	3	--------	71
6. 5	7. 6	1. 00	. 088	11. 4	. 51	----------	37. 5	. 28	1. 17	1	--------	64
6. 3	7. 6	. 69	. 055	12. 5	. 29	----------	39. 2	. 40	. 90	1	--------	64
6. 9	8. 2	. 67	--------	--------	. 42	----------	40. 0	. 74	. 90	2	--------	65
7. 2	8. 7	. 55	--------	--------	. 48	2. 0	39. 7	. 85	. 87	2	--------	69
7. 6	9. 1	. 23	--------	--------	. 52	13. 0	40. 5	1. 42	. 86	4	--------	71
7. 7	9. 0	. 15	--------	--------	. 67	19. 7	35. 1	1. 73	. 72	5	--------	60
6. 8	7. 6	1. 48	. 131	11. 3	. 72	----------	20. 5	. 37	1. 47	--------	90	35
6. 8	7. 8	. 83	. 086	9. 7	. 50	----------	20. 0	. 33	1. 24	--------	90	39
6. 9	7. 8	. 47	. 061	7. 7	. 37	----------	22. 2	. 36	1. 04	--------	87	43
6. 6	7. 6	. 52	--------	--------	. 35	----------	26. 9	. 41	. 83	--------	87	49
7. 4	8. 3	. 44	--------	--------	. 49	17. 3	16. 7	. 28	. 60	--------	--------	41
7. 6	8. 6	. 26	--------	--------	. 43	28. 4	10. 9	. 35	. 56	--------	--------	35
7. 7	8. 8	. 14	--------	--------	. 56	27. 0	10. 5	. 12	. 22	--------	--------	34
7. 4	7. 6	. 35	. 033	10. 6	----------	----------	4. 2	. 20	. 38	5	--------	22
7. 5	7. 6	. 21	. 025	8. 4	----------	----------	4. 8	. 20	. 38	4	--------	25
7. 6	7. 6	. 09	. 015	6. 0	----------	----------	3. 4	. 20	. 32	6	--------	26
7. 8	7. 6	. 03	. 007	4. 3	----------	----------	2. 9	. 14	. 30	5	--------	25
7. 8	7. 5	. 06	--------	--------	----------	----------	2. 5	. 14	. 28	6	--------	27
7. 8	7. 9	. 05	--------	--------	----------	----------	2. 8	. 20	. 31	7	--------	23
7. 8	9. 0	13. 61	1. 165	11. 7	2. 0	25. 3	50. 2	1. 68	2. 65	--------	--------	143
7. 8	8. 6	1. 82	. 132	13. 8	. 8	4. 9	26. 2	. 98	1. 19	--------	--------	--------
7. 6	8. 4	1. 03	. 080	12. 9	. 6	5. 4	22. 5	----------	----------	--------	--------	--------
7. 6	8. 6	. 65	. 061	10. 7	. 7	22. 5	12. 8	----------	----------	--------	--------	--------
7. 6	8. 6	. 59	. 054	10. 7	. 8	30. 4	6. 1	----------	----------	--------	--------	--------
(3)	(3)	--------	--------	--------	----------	39. 4	4. 3	----------	----------	--------	--------	--------
7. 8	9. 0	. 75	. 075	10. 0	. 96	. 5	13. 5	. 58	1. 18	4	--------	29
8. 0	9. 7	. 58	. 068	8. 5	1. 57	. 8	15. 6	3. 51	1. 20	23	--------	38
8. 7	10. 2	. 39	--------	--------	2. 15	5. 5	13. 8	6. 61	1. 11	48	--------	34
9. 3	10. 5	. 28	--------	--------	4. 89	30. 7	10. 0	7. 33	. 75	73	--------	43
9. 3	10. 4	. 21	--------	--------	6. 11	26. 0	9. 5	8. 18	. 81	86	--------	42
8. 9	10. 2	. 21	--------	--------	6. 11	30. 7	18. 5	13. 22	1. 23	71	--------	72
7. 8	8. 8	. 91	. 093	9. 8	. 77	47. 6	10. 2	. 12	. 35	1	--------	24
7. 6	8. 8	. 85	. 095	8. 9	. 53	40. 0	9. 9	. 10	. 21	1	--------	29
7. 7	8. 9	. 68	--------	--------	. 63	48. 1	5. 9	. 10	. 08	2	--------	29
8. 1	8. 9	1. 85	--------	--------	1. 25	11. 4	26. 3	. 50	. 30	2	--------	51
8. 1	9. 0	. 88	--------	--------	. 92	50. 4	11. 5	. 31	1. 92	3	--------	52
8. 0	9. 0	. 39	--------	--------	. 69	50. 7	10. 7	. 29	1. 04	3	--------	50
8. 1	9. 0	--------	--------	--------	. 61	34. 9	13. 6	. 34	. 83	3	--------	51
8. 1	9. 0	--------	--------	--------	. 55	29. 7	12. 0	. 32	. 57	3	--------	47

TABLE 7.—*Laboratory analyses*

Soil name	Depth from surface	Size-class and diameter of particles								Moisture held at tension of 15 atmospheres
		Very coarse sand (2–1 mm.)	Coarse sand (1–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.10 mm.)	Very fine sand (0.10–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)	>2.0 mm.	
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
St. Marys gravelly very fine sandy loam.	0–9	1.9	4.6	5.2	15.9	24.7	35.0	12.6	32	8.5
	9–16	1.5	6.3	14.6	27.7	16.1	21.5	12.3	34	6.3
	16–27	4.0	10.4	11.0	22.6	22.7	22.1	7.2	55	3.3
	27–60	2.9	9.7	9.0	17.4	21.4	28.9	10.7	66	8.4
Salt Lake silty clay.	0–6	3.5	.4	.2	.4	.4	43.0	52.1	---	36.2
	6–16	.3	.7	.6	1.6	3.4	47.0	46.4	---	19.4
	16–36	.1	.2	.2	.7	2.2	41.3	55.3	---	18.5
	36–66	0	.1	.1	.2	.7	41.4	57.5	---	21.2
Scave silt loam.	0–10	.7	1.4	1.3	5.6	14.8	54.3	21.9	[2] 5	12.4
	10–16	1.3	2.5	1.7	5.1	12.8	55.6	21.0	[2] 15	9.9
	16–34	2.0	3.6	2.6	11.4	30.0	38.5	11.9	[2] 35	5.2
	34–46	2.3	4.3	2.6	7.3	15.7	42.3	42.0	[2] 60	17.6
Scout gravelly loam.	0–4	3.4	4.0	2.9	8.5	22.6	49.9	8.7	34.7	6.9
	4–11	4.5	4.8	2.9	9.3	23.5	46.9	8.1	39.0	4.9
	11–18	4.2	4.9	3.5	10.8	25.8	45.2	5.6	38.2	2.9
	18–32	3.4	5.7	4.2	14.2	31.2	37.3	4.0	39.7	1.8
	32–62	13.0	10.9	5.0	12.0	17.7	38.6	2.8	83.3	1.9
Shay silty clay loam.	0–14	.1	1.3	.4	2.4	10.2	55.0	29.8	---	---
	14–30	0	0	.1	.4	1.4	44.3	53.8	---	---
	30–44	.5	.8	1.9	7.6	14.8	50.9	23.5	---	---
	44–58	.1	.2	2.6	31.7	26.7	27.2	11.5	---	---
Steed gravelly loam.	0–5	1.6	5.0	5.8	11.1	13.7	44.7	18.1	23	10.5
	5–11	2.2	5.8	6.1	11.2	13.6	40.5	20.6	35	10.1
	11–17	4.0	11.5	10.4	14.1	12.6	29.7	17.7	69	8.3
	17–60	15.9	28.3	18.2	15.3	6.9	8.6	6.8	79	2.9
Trenton silty clay loam.	0–8	0	.1	.1	.4	2.7	65.9	30.8	---	13.0
	8–15	0	.1	.1	.2	1.7	54.3	43.6	---	19.3
	15–26	0	.1	.1	.3	1.4	56.0	42.1	---	17.8
	26–34	0	0	0	.1	.2	46.7	53.0	---	18.5
	34–46	0	0	0	.1	.3	42.9	56.7	---	21.8
	46–60	0	0	0	.2	.4	41.6	57.8	---	23.9
	60–72	0	0	.1	.1	.6	46.0	53.2	---	24.3
Wheelon silt loam.	0–6	.1	.4	.5	2.6	15.4	54.3	26.7	---	17.1
	6–12	0	.2	.2	1.5	11.8	54.3	32.0	---	20.5
	12–23	0	.2	.3	1.9	15.9	54.6	27.1	---	16.5
	23–35	0	.6	1.3	5.0	16.9	52.0	24.2	---	15.6
	35–43	.2	1.4	1.6	3.5	15.1	58.2	20.0	---	16.9
	43–66	.2	1.8	1.5	2.5	13.8	57.6	22.6	---	18.5
Yeates Hollow extremely stony silt loam (in an area of Yeates Hollow extremely rocky silt loam).	0–11	2.6	7.6	5.2	7.6	7.3	50.6	19.1	(2)	7.2
	11–18	3.5	7.0	4.7	6.4	5.6	47.0	25.8	(2)	9.1
	18–33	3.7	7.8	5.6	8.1	6.7	30.0	38.1	(2)	12.5
	33–46	2.0	8.2	7.1	11.0	7.8	30.7	32.2	(2)	13.1

[1] Values are representative of a mixture of A2 and B2t horizons that could not be separated in sampling.

[2] Fragments greater than 3 inches in diameter were discarded from sample.

of selected soils—Continued

Reaction		Organic matter			Electrical conductivity	Calcium carbonate equivalent	Meq. per 100 grams of soil			Exchangeable sodium	Base saturation	Moisture at saturation
Saturated paste	1: 5 H_2O	Organic carbon	Nitrogen	Carbon-nitrogen ratio			Cation-exchange capacity (sodium acetate)	Extractable cations				
								Sodium	Potassium			
pH	*pH*	*Pct.*	*Pct.*		*Mmhos./cm. at 25° C.*	*Pct.*				*Pct.*	*Pct.*	*Pct.*
6. 2	7. 3	3. 04	0. 227	13. 3	0. 66	--------	20. 6	0. 14	0. 45	--------	71	48
6. 2	7. 0	1. 45	. 118	12. 2	. 52	--------	13. 6	. 10	. 24	--------	82	37
6. 7	7. 4	. 55	--------	--------	. 58	--------	5. 8	. 10	. 08	--------	97	29
6. 7	8. 1	1. 88	--------	--------	. 95	8. 3	14. 1	. 12	. 10	--------	91	54
7. 6	8. 2	12. 1	. 833	14. 5	2. 3	18. 2	53. 8	1. 7	. 80	3	--------	113
8. 0	8. 6	2. 06	. 172	12. 0	1. 5	49. 6	23. 5	1. 4	. 67	6	--------	65
8. 3	8. 6	. 75	--------	--------	2. 7	44. 1	20. 2	3. 9	1. 12	19	--------	66
8. 9	9. 4	. 31	--------	--------	2. 3	36. 0	23. 1	7. 8	1. 40	34	--------	92
5. 8	6. 7	4. 34	. 269	16. 1	. 62	. 1	30. 8	. 20	1. 68	--------	72	53
6. 0	6. 9	1. 46	. 121	12. 1	. 39	--------	20. 1	. 18	1. 07	--------	74	39
6. 1	7. 0	. 47	--------	--------	. 42	--------	8. 3	. 17	. 41	--------	74	27
5. 6	6. 7	. 56	--------	--------	. 26	--------	32. 0	. 25	1. 07	--------	87	52
6. 5	7. 4	2. 38	. 123	19. 3	. 90	--------	14. 6	. 15	. 71	--------	72	43
6. 4	7. 0	1. 23	. 059	20. 8	. 55	--------	9. 5	. 13	. 57	--------	58	32
6. 0	6. 3	. 25	--------	--------	. 40	--------	4. 5	. 13	. 25	--------	60	22
5. 6	6. 5	. 07	--------	--------	. 17	--------	2. 1	. 12	. 08	--------	67	19
5. 5	6. 3	. 04	--------	--------	. 26	--------	1. 9	. 11	. 10	--------	67	23
7. 4	8. 0	3. 51	. 275	12. 8	1. 34	12. 9	38. 3	. 4	--------	1	--------	64
7. 4	8. 4	2. 37	. 167	14. 2	. 76	6. 7	48. 9	. 4	--------	1	--------	81
7. 6	8. 5	. 90	. 076	11. 8	. 68	13. 5	28. 7	. 4	--------	1	--------	55
7. 9	8. 7	. 43	. 037	11. 6	. 77	21. 3	12. 9	. 3	--------	2	--------	35
7. 6	8. 3	3. 09	. 227	13. 6	. 8	10. 0	22. 8	. 30	1. 62	1	--------	51
7. 5	8. 0	2. 31	. 196	11. 8	. 8	11. 3	21. 9	. 33	. 90	2	--------	43
7. 6	8. 2	1. 83	. 132	13. 9	. 8	7. 2	16. 9	. 21	. 58	1	--------	36
7. 7	8. 6	. 56	--------	--------	. 4	5. 8	5. 3	. 37	. 32	7	--------	24
7. 6	8. 1	1. 16	. 104	11. 2	1. 28	--------	24. 5	. 5	1. 86	2	--------	66
7. 5	8. 8	. 64	. 064	10. 0	. 85	1. 2	26. 7	1. 3	1. 97	5	--------	53
8. 1	9. 6	. 38	. 042	9. 0	1. 16	20. 5	23. 2	3. 3	1. 15	14	--------	62
8. 5	9. 9	. 24	. 031	7. 7	2. 44	39. 6	21. 8	6. 0	1. 14	27	--------	100
8. 3	9. 5	. 23	--------	--------	8. 06	32. 4	22. 4	6. 9	1. 08	33	--------	93
8. 2	9. 4	. 24	--------	--------	9. 00	27. 2	24. 4	7. 4	1. 21	30	--------	98
8. 5	9. 3	. 20	--------	--------	11. 97	23. 0	24. 1	7. 4	1. 36	37	--------	100
7. 8	8. 7	. 87	. 099	8. 8	1. 42	14. 7	31. 2	. 82	4. 85	3	--------	51
7. 8	8. 5	. 76	. 089	8. 5	. 48	16. 5	33. 3	. 81	6. 64	2	--------	62
7. 9	9. 3	. 39	. 056	7. 0	. 48	30. 7	26. 5	1. 57	6. 59	6	--------	56
8. 2	9. 5	. 36	--------	--------	1. 47	34. 4	26. 3	9. 39	7. 21	36	--------	60
8. 3	9. 7	. 24	--------	--------	. 69	36. 7	28. 2	8. 78	5. 49	31	--------	49
8. 3	9. 6	. 14	--------	--------	. 85	29. 2	30. 2	8. 95	5. 67	30	--------	57
6. 6	7. 5	1. 26	. 105	12. 0	. 78	--------	15. 8	. 19	1. 87	--------	83	29
6. 7	7. 5	. 82	. 070	11. 7	. 45	--------	16. 9	. 20	1. 55	--------	88	34
6. 3	7. 1	. 45	--------	--------	. 31	--------	. 9	. 22	. 90	--------	81	36
5. 9	7. 0	. 49	--------	--------	. 18	--------	23. 8	. 23	. 53	--------	77	39

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[3] Insufficient sample.

[4] Values were estimated. Fragments greater than 3 inches in diameter were discarded from sample.

Methods of Analysis

All samples were air-dried in the laboratory. Then, they were sieved by hand through the use of sieves 8 inches in diameter with round openings 2 millimeters in diameter. Samples that appeared to have no significant amount of pebbles or stones (less than 5 percent) were poured through a mechanical crusher that has openings of about 4 millimeters. Samples that had significant amounts of pebbles or stones were broken up in an iron mortar without crushing the pebbles or stones. If it was necessary to reduce the size of the sample, a Riffle sampler was used. Each laboratory sample was mixed thoroughly to insure uniformity, and all subsequent analyses were made on the fraction less than 2 millimeters in diameter. The percentage of material greater than 2 millimeters in diameter was calculated by dividing the weight of the fraction retained on the 2 millimeter sieve by the initial weight of the air-dry sample. Using a porcelain mortar and pestle, the subsamples less than 2 millimeters in diameter were ground small enough to pass a sieve having openings 0.3 millimeter in size. These subsamples were used to determine the organic carbon and calcium carbonate equivalent.

The official pipette method of analysis was used to determine particle-size distribution. Organic matter was destroyed by using hydrogen peroxide, but lime was not removed, except where specifically stated in the survey. Sodium hexametaphosphate was used as a dispensing agent. The sand fractions were determined by mechanical sieving through a series of sieves 2 inches in diameter. Except for glassware, all equipment used in making the analyses was furnished by the Soil Survey Laboratory at Beltsville, Md. The pipette method of analysis was used on the materials less than 2 millimeters in diameter. The amount of material larger than 2 millimeters is expressed on the basis of the total weight of the air-dry sample; the amount of sand, silt, and clay is expressed on the basis of the ovendry materials.

The moisture percentage at 15 atmospheres was determined by using the pressure membrane apparatus. Soil samples were placed in retaining rings 1 centimeter in depth and allowed to absorb water for at least 16 hours. Then, they were brought to equilibrium at the 15 atmosphere differential. Moisture is expressed as a percentage of the ovendry sample.

The reaction, or pH, was measured with a line-operated pH meter by using a glass electrode with a calomel reference electrode. In determining the pH of soil-water suspensions in the ratio of 1 to 5, the suspensions were stirred vigorously immediately before the electrodes were inserted. At the first indication of stabilization, the pH was read; then, the process was repeated until duplicate readings were obtained. Distilled water, or water free of carbon dioxide, was used for all soil-water suspensions.

The wet oxidation method using chromic acid was used to determine the content of organic carbon. Samples were heated during the oxidation process as described in the U.S. Department of Agriculture Handbook No. 60 (*9*). Silver sulfate was added to the sulfuric acid to prevent oxidation of chlorides for samples where soluble salts were 0.1 percent or more. After oxidation and dilution, an excess of ferrous ammonium sulfate was added to the sample, and the sample was then titrated with standard potassium permanganate. The permanganate also acted as an indicator, and a special titration light was used to help determine the exact endpoint.

The macro-Kjeldahl method was used to determine total nitrogen, with selinium as a catalyst. Enough water (about 15 to 20 milliliters) was added to the soil and other material in the flask to thoroughly wet the material before adding the acid for distillation. The distilled ammonia was caught in a boric acid solution of 2 percent that contained a special mixed indicator of bromcresol green and new coccine. The ammonia was then titrated with standard solution of $1/14$ N sulfuric acid, and the total amount of nitrogen was determined.

To determine the electrical conductivity of the saturation extract, a pipette cell with platinized platinum electrodes that had a cell constant of 0.5 was used along with a resistance bridge for measurement of EC_e. The pipette cell was equipped with a tapping key switch to avoid excessive flow of electric current, which could have heated the solution or polarized the electrodes. All values are expressed at 25° C.

To determine the calcium carbonate equivalent, the technician allowed variable weight of the sample to react in constant glass containers with 2 N hydrochloric acid. The percentage of calcium carbonate equivalent was determined by referring manometer readings to a curve prepared from standard samples of calcium carbonate.

In determining the cation-exchange capacity, samples of soil material less than 2 millimeters in diameter were saturated with sodium by four consecutive washings and centrifugations using 1 N sodium acetate solution that had been adjusted to pH 8.2. The soluble sodium acetate was removed by washing with a 95 percent solution of ethanol. The exchangeable sodium was then removed by three consecutive washings with neutral normal ammonium acetate. The amount of sodium was then measured on the flame photometer.

Extractable bases, sodium and potassium, are reported in table 8. Sodium was extracted by washing the sample three times with neutral, normal ammonium acetate, followed each time with centrifugation and filtering. The final extraction was at the ratio of 1 to 25. The amount of sodium in this extract was then measured using the flame photometer and lithium as the internal standard. Potassium was measured for the same extract and by the same method.

The exchangeable sodium percentage was derived by dividing the extractable sodium by the cation exchange capacity and multiplying the result by one hundred.

The base saturation percentage was determined by dividing the sum of extractable bases by the cation exchange capacity and multiplying the result by one hundred.

The moisture at saturation was obtained by drying a sample of the saturated paste mixed to meet saturation moisture criteria and determining the percent water.

Additional Facts About the Cache Area

This section describes the industries, community facilities, and settlement and development of the Cache Area. It also gives facts about the water supply, climate, and farming. Statistics for population and farming are from reports of the U.S. Bureau of the Census.

Industries

Several large industries have plants in the survey area. A sugar factory and a milk processing and canning plant are located in Lewiston. There is a large cheese factory in Amalga and a cheese packaging plant in Wellsville. A vegetable canning company is located in Smithfield. There are two meat packing plants located at Hyrum and one at Logan. Also located in Logan is a mobile home manufacturing concern, and a farm machinery company and a business form printing company are in the process of building plants near Logan. These and other industries offer seasonal employment, and many farmers supplement farm income with employment at these industries. Highway construction and building contractors, flour mills, and feed mixing plants offer employment in several communities. Utah State University also employs a large staff. Many people commute to defense and military establishments in adjacent Box Elder and Weber Counties.

Transportation

A main line of the Union Pacific Railroad enters Cache County through the gap where Bear River leaves the valley, passes through the towns of Newton and Cornish, and extends into Idaho. A spur line from Cache Junction serves the cities along the south and east sides of the valley.

From Brigham City and Salt Lake City to the south, U.S. Highways No. 899 and 91 enter the valley near Wellsville. At Logan the highways separate. U.S. Highway No. 89 extends east through Logan Canyon and U.S. Highway No. 91 extends north into Idaho. Paved State and county roads extend throughout the valley. The main paved road to the rangeland area passes through Blacksmith Fork Canyon to Hardware Ranch, where the road divides, and graded dirt roads extend northward and southward. Other dirt roads and trails cross the rangeland in the survey area.

The southern and eastern communities of the Cache Valley are served by natural gas. Electricity and culinary water are available in all rural and urban areas. Most of the culinary water comes from mountain springs and streams, but some communities supplement their supply with water from deep-pump wells.

Settlement and Development

The Indians of the region were Shoshoni. Before horses were acquired, they lived in primitive huts and subsisted on small game, birds, fish, berries, insects, and rodents. As horses became available, in 1750, the Indians rode in search of buffalo and other large game to supplement their diet. The buffalo hides also provided clothing and shelter.

John Weber's party of the Rocky Mountain Fur Company trapped beaver in the Cache Valley during the winter of 1824–25. Jim Bridger, a member of this party, followed the Bear River to its mouth and discovered Great Salt Lake. For several years he thought that he had reached the Pacific Ocean. Other trappers and explorers frequently passed through the valley. The valley became a popular place to cache furs before taking them east and also as a rendevous and supply point. This cache location is the origin of the name of Cache County.

On July 20, 1855, a company of Mormons with a large herd of cattle and horses arrived near the area where the town of Wellsville now stands. They were driven out by the severe winter that followed, but it marked the beginning of settlement. The next year, Wellsville was founded under the direction of Peter Maughan. Settlement of Providence, Mendon, Logan, Richmond, and Smithfield followed in 1859. These villages and others grew fast from the influx of Mormon converts and church members from the Salt Lake Valley.

Generally, the system of settlement was fort-style agricultural villages. Religious beliefs, community ties, and protection from Indian raids were largely responsible for this method of settlement. The city of Logan, having better irrigation facilities than other areas and having a more favorable location, grew rapidly and emerged as the business, educational, political, and religious center of Cache County. By 1890, Cache Valley had a population of 4,620. Banks, businesses, and industries began to prosper; almost every town was becoming self-sufficient, having churches, schools, general stores, banks, and mills. Under the Land Grant Act of 1888, the State of Utah authorized a college to be built at Logan; it is now Utah State University.

The campus of Utah State University is still located in Logan, and students can easily commute daily from towns in the survey area. Public elementary schools are available to all communities in the area. There are junior high schools in Hyrum, Logan, Richmond, and Lewiston. High schools are located in Smithfield and Logan.

The Logan Herald Journal is published daily in Logan. Two radio stations are in operation. Television is received from Salt Lake City. Utah State University also operates a radio and television station. Golf courses, movies, and swimming pools are available in the larger cities. Most communities have playgrounds and parks. Fishing is excellent in all streams and reservoirs. Hunting for upland game birds, waterfowl, deer, and elk is available in the area. Boating, water skiing, and facilities for other water sports are available on reservoirs in the area, as well as at Bear Lake. Beaver Mountain, in Logan Canyon, provides excellent skiing facilities.

Water Supply

Rainfall in the Cache Area is not adequate to produce maximum crop yields without supplemental water. Consequently, irrigation water is used wherever it is available. The first settlers started organized irrigation companies to construct diversions and canal systems. There are now about 45 of these mutual irrigation companies. Canals are mainly diversions from major streams. Since 1936, however, large reservoirs have been constructed in Cache County to irrigate additional acreage and to furnish a more dependable water supply. In 1936, Hyrum Dam was completed. The reservoir behind this dam has a capacity of 5,300 acre-feet and serves 2,225 acres. The latest reservoir to be completed is the Porcupine. It has a capacity of about 12,500 acre-feet and serves more than

2,500 acres. Additional reservoirs and canal systems are practicable and are being considered for construction in the future.

Many irrigation companies are lining their canals or are piping streams to conserve water and reduce maintenance. Sprinkler irrigation is replacing flood, furrow, or subirrigation methods on some farms to conserve water and increase efficiency.

Many areas of the Cache Valley are too wet for maximum crop production. On many farms in these areas, the soils are drained to lower the water table and to reduce the concentration of harmful salts in the root zone. Tile drains and open drains are used.

Climate [8]

In the Cache Area precipitation increases with elevation, and seasonal variations in precipitation are significant. In the farm areas of the Cache Valley, elevations range from 4,400 to 5,200 feet, and the average annual precipitation ranges from 16 to 20 inches. The mountains surrounding the valley rise to heights of more than 9,000 feet above sea level. Here, the average annual precipitation ranges from 20 to 35 inches. Rainfall is light in summer and is heaviest in spring. A considerable amount of the annual moisture is snow, most of which falls in the period from December through March. The average annual snowfall is between 60 and 80 inches in the Cache Valley and is as much as several hundred inches in the higher elevations.

Winters are cold but generally are not severe. In an average year, 6 to 12 days have a minimum temperature that is below zero and 35 to 40 days have a maximum that is 32° F. or below.

The daily temperature in summer ranges from a minimum in the 50's to a maximum in the 80's. Maximum temperatures of 90° or higher occur on an average of less than 25 days a year. Since temperatures were first recorded in 1891, a temperature of 100° or higher has been reported six times.

Winds generally are light, but winds from Logan and Blacksmith Fork Canyon sometimes reach a velocity of more than 80 miles per hour.

Thunderstorms sometimes occur in summer, but the amount of precipitation received usually is small. Hail is rare, and the stones generally are small. The frost-free period is about 7 days in the vicinity of Hardware Ranch and about 164 days at Utah State University in Logan. The growing season for most of the farming area in the Cache Valley ranges from 114 to 150 days. The growing season is slightly longer along the higher lake terraces and mountain foot slopes. The base of the temperature inversion at which the growing season is longest ranges from about 600 to 1200 feet above the valley floor. Tables 8 and 9 show the characteristics of temperature and precipitation in the Cache Area. Climatic data for Logan are based on a 71- to 76-year record; those for Lewiston are based on a 41-year record.

Farming

Most farming in the Cache Area is dairying and the raising of livestock. Farming is generally diversified, but livestock is raised on many farms so that pasture, hay, and grain can be used as feed for dairy and beef cattle. Sugar beets, peas, corn, and alfalfa are grown as cash crops. On nonirrigated farms wheat and barley are grown as cash crops.

Some apples, pears, sour cherries, and other fruits are grown in the survey area. Orchards are concentrated in the North to Providence area, where the hazard of frost is reduced by good air drainage. Smaller orchards and individual fruit trees are grown by farm families throughout the valley.

Soils on the lower terraces and on the floor of Cache Valley have several limitations to use for farming. The high water table and accumulations of salt and alkali limit the use of soils in these areas. The intensity of these limitations varies widely, as do the practices necessary for reclamation of the soils. Frost damage late in spring and early in fall is more likely in these areas than on higher terraces.

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[8] ARLO RICHARDSON, climatologist for Utah, National Weather Service, U.S. Department of Commerce, helped to prepare this section.

TABLE 8.—*Probability of last freezing temperature in spring and first in fall at Logan, Utah*

[Station at Utah State University]

Probability	Dates for stated probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	March 27	April 7	April 18	May 2	May 23
2 years in 10 later than	March 19	March 31	April 11	April 25	May 16
5 years in 10 later than	March 7	March 18	March 29	April 12	May 3
Fall:					
1 year in 10 earlier than	November 4	October 30	October 23	October 14	September 27
2 years in 10 earlier than	November 9	November 5	October 29	October 20	October 3
5 years in 10 earlier than	November 20	November 16	November 10	October 29	October 14

TABLE 9.—*Temperature and precipitation in the Cache Area, Utah*

LOGAN (UTAH STATE UNIVERSITY, ELEVATION 4,785 FEET)

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Days with snow cover	Average snowfall
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	° F.	*° F.*	*° F.*	*° F.*	*In.*	*In.*	*In.*	*Number*	*In.*
January	32. 3	15. 0	45	−6	1. 62	0. 65	2. 74	20	17. 1
February	37. 8	20. 1	50	−3	1. 49	. 61	2. 88	15	11. 3
March	46. 4	26. 4	61	14	1. 81	. 89	2. 61	9	10. 6
April	59. 2	36. 4	73	26	2. 09	. 77	3. 85	2	3. 3
May	73. 6	44. 2	83	35	1. 88	. 80	3. 18	(1)	4. 2
June	75. 7	50. 3	88	42	1. 51	. 44	3. 40	0	0
July	87. 6	58. 4	94	51	. 38	. 03	. 89	0	0
August	86. 0	57. 3	92	49	. 75	. 01	2. 25	0	0
September	76. 3	48. 5	86	39	1. 05	. 11	2. 18	0	(2)
October	63. 4	39. 6	76	30	1. 50	. 05	3. 07	1	1. 5
November	43. 8	27. 0	62	13	1. 71	. 44	3. 17	5	6. 5
December	36. 4	20. 7	48	8	1. 57	. 57	2. 36	14	11. 5
Year	59. 8	36. 9	----------	----------	17. 36	----------	----------	66	66. 0
LEWISTON, UTAH (ELEVATION 4,480 FEET)									
January	31. 7	9. 6	44	−8	1. 80	. 71	3. 26	----------	17. 1
February	35. 3	15. 4	49	−10	1. 55	. 64	2. 58	----------	11. 0
March	46. 1	22. 9	60	8	1. 73	. 62	2. 97	----------	10. 4
April	59. 3	32. 3	73	23	1. 97	. 91	3. 57	----------	3. 4
May	89. 6	39. 0	82	31	1. 98	. 50	3. 54	----------	. 2
June	78. 2	44. 1	90	37	1. 69	. 49	3. 69	----------	0
July	89. 4	49. 8	95	43	. 50	. 04	1. 45	----------	0
August	87. 5	48. 0	94	40	. 88	(1)	1. 82	----------	0
September	77. 5	39. 6	89	31	1. 05	. 06	2. 38	----------	0
October	64. 6	31. 7	78	23	1. 49	. 04	3. 38	----------	1. 0
November	45. 0	23. 0	59	18	1. 61	. 19	3. 41	----------	4. 8
December	36. 1	16. 9	48	−2	1. 65	. 62	2. 91	----------	12. 2
Year	60. 1	31. 0	----------	----------	17. 90	----------	----------	----------	60. 1

[1] About one-half day.
[2] Trace.

The upper terraces and benches of the valley generally are better drained than other areas and are free of soluble salts. Frost damage is less likely in this area, particularly on the east side, than in other areas. The principal management needs are controlling erosion and improving the management of irrigation water.

The areas used for dryland crops are in the northwestern part of the Cache Valley. They extend along the western sides of the valley to the southwestern and southeastern parts. These areas generally are on high and medium terraces and on mountain foot slopes.

About 60 percent of the survey area is used for grazing by sheep and cattle. Much of the range vegetation has deteriorated since the area was settled. In recent years better methods of range management and increased use of chemical sprays on sagebrush and mulesear dock have greatly improved grass production on ranches in the Area.

The acreage of principal crops grown in Cache County for the year 1964 is as follows:

Crop	*Acres*
Corn, cut for silage	3, 616
Wheat, winter wheat harvested	31, 137
Wheat, spring wheat harvested	9, 635
Barley, harvested	26, 488
Oats, harvested	1, 416
Alfalfa hay	48, 015
Wild hay	3, 293
Alfalfa seed	1, 463
Irish potatoes	270
Sugar beets	4, 419
Sweet corn	870
Green peas	348
Apple trees (bushels)	144, 576
Pears (bushels)	3, 397
Cherries (pounds)	41, 475
Peaches (bushels)	1, 150

The Cache Area has large acreages of range and pasture. This acreage and the irrigated acreage of hay and other feed make efficient and extensive production of livestock possible. Herefords are the principal breed of beef cattle, but small herds of other breeds also are raised. Most of the calves from beef herds and the Holstein steers from the dairy herds are retained and fed in farm feedlots in the valley.

Most of the dairy herds are of the Holstein-Friesian breed. There also are a few herds of Jersey and Guernsey cattle. The milk is manufactured into cheese or condensed and canned milk or is marketed as whole milk. Some of the milk is shipped to markets as far away as Denver, Colorado, in refrigerated trucks.

Sheep are raised mainly for meat and wool. Most of the lambs are sold to feeders or packers outside the valley. Most herds are wintered on desert ranges in western Utah and eastern Nevada.

The kinds and numbers of livestock raised in Cache County in the year 1964 are as follows:

Livestock	*Number*
Cattle, including calves	49,913
Dairy cows	13,579
Hogs and pigs	2,417
Sheep and lambs	30,561
Chickens	76,806
Turkeys	44,175

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Border irrigation. See Irrigation.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Cemented (soil material). See Consistence, soil.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Drainage, soil. See Natural soil drainage.

Dryfarming. Production of crops that require some tillage in a subhumid or semiarid region, without irrigation. Usually involves use of periods of fallow, during which time enough moisture accumulates in the soil to allow production of a cultivated crop.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. Summer fallow is a common stage before cereal grain in regions of limited rainfall. The soil is tilled for at least one growing season to control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Furrow irrigation. See Irrigation.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Igneous rock. Rock that has been formed by the cooling of molten mineral material. Examples: Granite, syenite, diorite, and gabbro.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Lime. Chemically, lime is calcium oxide (CaO), but its meaning has been extended to include all limestone-derived materials applied to neutralize acid soils. Agricultural lime can be obtained as ground limestone, hydrated lime, or burned lime, with or without magnesium minerals. Basic slag, oystershells, and marl also contain calcium.

Mechanical analysis (soils). The percentage of the various sizes of individual mineral particles, or separates, in the soil. Also, a laboratory method of determining soil texture.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil and carbon, hydrogen, and oxygen obtained largely from the air and water, are plant nutrients.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range (rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land on which there are some forest trees.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; or contains harmful salts and has a highly alkaline reaction; or contains harmful salts and exchangeable sodium and is strongly alkaline in reaction. The salts, exchangeable sodium, and alkaline reaction are so distributed in the soil in such locations that growth of most crop plants is significantly less than normal.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand), or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface layer. A term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

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GUIDE TO MAPPING UNITS

Soils in the Cache Area were mapped at two intensities of detail. Those areas used mainly for farming were mapped at a high intensity of detail, and they are identified by map symbols composed of both uppercase and lowercase letters of the alphabet. The remaining soils, used mainly for range and as woodland, were mapped at a low intensity of detail. They are identified by map symbols composed entirely of uppercase letters. Dashes in columns headed Range site and Woodland suitability group mean the soil is used mainly for farming. For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. For complete information about a capability unit, refer to the subsection "Management by Capability Units" beginning on page 96. For information about Woodland suitability groups see pages 117 and 118. For information about Wildlife suitability groups see pages 119 and 120. Other information is given in tables as follows:

Acreage and extent, table 1, p. 8.	Engineering uses of the soils, tables 3, 4, and 5, pp. 122 to 165.
Predicted yields, table 2, p. 108.	

			Capability unit Irrigated		Capability unit Nonirrigated		Range site		Woodland suitability group	Wildlife suitability group
Map symbol	Mapping unit	Page	Symbol	Page	Symbol	Page	Name	Page	Number	Number
AAE	Agassiz rocky silt loam, 6 to 30 percent slopes------------	7	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
AAG2	Agassiz rocky silt loam, 30 to 70 percent slopes, eroded----	10	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
ABG2	Agassiz-Bradshaw association, eroded------------------------	10								
	Agassiz soil----------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Bradshaw soil--------------	--	------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
ADG2	Agassiz-Dateman association, eroded-----------------------	10								
	Agassiz soil---------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Dateman soil---------------	--	------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
AEG2	Agassiz-Elwood association, eroded-----------------------	10								
	Agassiz soil---------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Elwood soil----------------	--	------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
AGE	Agassiz-Goring association-----	11								
	Agassiz soil---------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Goring soil----------------	--	------	---	VIe-M	105	Mountain Loam	112	------	3
AGG2	Agassiz-Goring association, eroded-----------------------	11								
	Agassiz soil---------------	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Goring soil----------------	--	------	---	VIIe-M	106	Mountain Loam	112	------	3
AhA	Airport silt loam, 0 to 3 percent slopes---------------	11	IVw-28	104	--------	---	Alkali Bottom	111	------	1
Ak	Airport silty clay loam--------	12	IVw-28	104	--------	---	Alkali Bottom	111	------	1
Am	Airport-Salt Lake complex------	12								
	Airport soil---------------	--	IVw-28	104	--------	---	Alkali Bottom	111	------	1
	Salt Lake soil-------------	--	IVw-28	104	--------	---	Wet Meadow	116	------	---
AND	Ant Flat loam, 6 to 20 percent slopes------------------------	13	------	---	VIe-M	105	Mountain Loam	112	------	3
AOE2	Ant Flat-Despain association, eroded-----------------------	13								
	Ant Flat soil--------------	--	------	---	VIe-M5	105	Mountain Clay	112	------	3
	Despain soil---------------	--	------	---	VIe-M	105	Mountain Loam	112	------	3
ArA	Avon silty clay loam, 0 to 3 percent slopes---------------	14	IIc-2	97	IIe-M	96	-----------------	---	------	3
ArB	Avon silty clay loam, 3 to 6 percent slopes---------------	14	IIe-2	96	IIe-M	96	-----------------	---	------	3

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Page	Capability unit Nonirrigated Symbol	Page	Range site Name	Page	Woodland suitability group Number	Wildlife suitability group Number
ArC	Avon silty clay loam, 6 to 10 percent slopes	15	IIIe-2	98	IIIe-M	98	Mountain Loam	112	------	3
ArD	Avon silty clay loam, 10 to 20 percent slopes	15	IVe-2	102	IVe-M	103	Mountain Loam	112	------	3
AsC	Avon-Collinston complex, 6 to 10 percent slopes	15	IIIe-2	98	IIIe-M	98	Mountain Loam	112	------	3
AsE	Avon-Collinston complex, 10 to 30 percent slopes	15	------	----	IVe-M	103	Mountain Loam	112	------	3
BAF	Barfuss-Leatham association	15								
	Barfuss soil	--	------	----	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Leatham soil	--	------	----	VIIe-U	106	Upland Loam	115	------	2
BcA	Battle Creek silty clay loam, 0 to 2 percent slopes	16	IIIs-25	102	IIIs-U5	102	-----------------	---	------	2
BcD	Battle Creek silty clay loam, 8 to 15 percent slopes	17	IVe-2	102	IVe-U5	103	-----------------	---	------	2
BGG	Bickmore gravelly silt loam, 30 to 70 percent slopes	17	------	----	VIIe-HC	106	High Mountain Loam (Conifer)	112	4rl	4
BKG2	Bickmore-Agassiz association, eroded	18								
	Bickmore soil	--	------	----	VIIe-HC	106	High Mountain Loam (Conifer)	112	4rl	4
	Agassiz soil	--	------	----	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Picayune soil	--	------	----	VIIe-M4	106	Mountain Loam	112	------	3
BLG2	Bickmore-Sheep Creek association, eroded	18								
	Bickmore soil	--	------	----	VIIe-HC	106	High Mountain Loam (Conifer)	112	4rl	4
	Sheep Creek soil	--	------	----	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Agassiz soil	--	------	----	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
BmB	Blackrock gravelly loam, 3 to 6 percent slopes	19	IIe-2	96	IIIe-UX	100	-----------------	---	------	2
BmC	Blackrock gravelly loam, 6 to 10 percent slopes	19	IIIe-2	98	IIIe-UXE	100	Upland Loam	115	------	2
BmD	Blackrock gravelly loam, 10 to 20 percent slopes	18	------	----	IVe-UX	104	Upland Loam	115	------	2
BnD	Blackrock extremely stony loam, 10 to 20 percent slopes	19	------	----	VIIs-U4	107	Upland Stony Loam	115	------	2
BSG2	Bradshaw-Agassiz association, eroded	19								
	Bradshaw soil	--	------	----	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Agassiz soil	--	------	----	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
Ca	Cache silty clay	20	------	----	VIIIw-28	107	-----------------	--	------	1
Cd	Cardon silty clay	20	IIIw-25	101	--------	---	Wet Meadow	116	------	1
CE	Center Creek silt loam	21	IIIw-3	101	--------	---	Wet Meadow	116	------	1
CFE	Clegg silt loam, 20 to 30 percent slopes	22	------	----	VIe-MN	105	Mountain Loam (Shrubs)	112	------	3
CGE	Cluff silt loam, 6 to 30 percent slopes	23	------	----	VIe-HC	105	High Mountain Loam (Conifer)	112	4ol	4
CHE	Cluff-Lucky Star association	23								
	Cluff soil	--	------	----	VIe-HC	105	High Mountain Loam (Conifer)	112	4ol	4
	Lucky Star soil	--	------	----	VIe-HA	104	High Mountain Loam (Aspen)	111	2ol	4
CIE	Cluff-Scout association	23	------	----	VIe-HC	105	High Mountain Loam (Conifer)	112	4ol	4
Ck	Collett silty clay loam	24	IIIw-25	101	--------	---	Wet Meadow	116	------	1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Page	Capability unit Nonirrigated Symbol	Page	Range site Name	Page	Woodland suitability group Number	Wildlife suitability group Number
ClA	Collinston loamy fine sand, 0 to 3 percent slopes	25	IIIs-24	101	IIIs-U4	102	-----------------	---	------	2
CmC	Collinston loam, 1 to 6 percent slopes	25	-------	---	IIIe-U	99	-----------------	---	------	2
CmD	Collinston loam, 6 to 10 percent slopes	25	-------	---	IVe-U	103	-----------------	---	------	2
CmE2	Collinston loam, 10 to 30 percent slopes, eroded	25	-------	---	VIe-U	105	Upland Loam	115	------	2
CoA	Crookston loam, 0 to 3 percent slopes	26	IIc-2	97	IIIe-U	99	-----------------	---	------	2
CoB	Crookston loam, 3 to 6 percent slopes	26	IIe-2	96	IIIe-U	99	-----------------	---	------	2
CoC	Crookston loam, 6 to 10 percent slopes	26	IIIe-2	98	IIIe-UE	100	-----------------	---	------	2
CrB	Crowshaw gravelly loam, 3 to 6 percent slopes	27	IIe-2	96	IIIe-UX	100	-----------------	---	------	2
CrC	Crowshaw gravelly loam, 6 to 10 percent slopes	27	IIIe-2	98	IIIe-UXE	100	-----------------	---	------	2
CrD	Crowshaw gravelly loam, 10 to 20 percent slopes	27	-------	---	IVe-UX	104	Upland Loam	115	------	2
CSE	Curtis Creek-Goring association, hilly	27								
	Curtis Creek soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Goring soil	--	-------	---	VIe-M	105	Mountain Loam	112	------	3
CSG	Curtis Creek-Goring association, steep	28								
	Curtis Creek soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
	Goring soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Lucky Star soil	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	------	3
DaC	Dagor silt loam, 4 to 8 percent slopes	29	IIIe-2	98	IIIe-M	98	-----------------	---	------	3
DaD	Dagor silt loam, 10 to 20 percent slopes	28	IVe-2	102	IVe-M	103	-----------------	---	------	3
DEG	Dateman extremely rocky silt loam, 40 to 80 percent slopes	29	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4x1	4
DHG	Dateman-Bradshaw association	29								
	Dateman soil	--	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
	Bradshaw soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
DLG	Datwyler cobbly silty clay loam, 30 to 60 percent slopes	30	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
DNG	Datwyler-Elzinga-Maughan association	30								
	Datwyler soil		-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Elzinga soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Maughan soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
DPG	Despain-Bickmore association	31								
	Despain soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Bickmore soil	--	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
DSG	Despain-Lucky Star association	31								
	Despain soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Lucky Star	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2r1	4

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit: Irrigated Symbol	Irrigated Page	Capability unit: Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Woodland suitability group Number	Wildlife suitability group Number
EDG	Elwood silt loam, 30 to 60 percent slopes	32	------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
EGE	Elwood-Agassiz association	32								
	Elwood soil	--	------	---	VIe-HC	105	High Mountain Loam (Conifer)	112	4o1	4
	Agassiz soil	--	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	-----	3
EME	Elwood-Mult association, hilly	32								
	Elwood soil	--	------	---	VIe-HC	105	High Mountain Loam (Conifer)	112	4o1	4
	Mult soil	--	------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
EMG	Elwood-Mult association, steep	32								
	Elwood soil	--	------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
	Mult soil	--	------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2r1	4
FGD	Fitzgerald extremely stony loam, 10 to 20 percent slopes	34	------	---	VIIs-HXC	106	High Mountain Loam (Conifer)	112	4x1	4
FLD	Flygare silt loam, 3 to 20 percent slopes	34	------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
FOG	Foxol rocky loam, 30 to 60 percent slopes	35	------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
GGE	Goring silt loam, 6 to 30 percent slopes	35	------	---	VIe-M	105	Mountain Loam	112	------	3
GOE2	Goring-Obray association, eroded	36								
	Goring soil	--	------	---	VIe-M5	105	Mountain Clay	112	------	3
	Obray soil	--	------	---	VIe-M5	105	Mountain Clay	112	------	3
	Yeates Hollow soil	--	------	---	VIIs-MX5	107	Mountain Stony Clay	113	------	3
Gp	Gravel pit	36	------	---	VIIIs-4	107	----------------	---	------	---
GrA	Green Canyon gravelly loam, 0 to 3 percent slopes	37	IVs-24	104	VIs-U4	105	----------------	---	------	2
GrB	Green Canyon gravelly loam, 3 to 7 percent slopes	36	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
GsA	Greenson loam, 0 to 3 percent slopes	38	IIw-2	97	--------	---	----------------	---	------	1
GsB	Greenson loam, 3 to 6 percent slopes	38	IIw-2	97	--------	---	Semiwet Meadow	115	------	1
GsC	Greenson loam, 6 to 10 percent slopes	38	IIIe-2	98	--------	---	Semiwet Meadow	115	------	1
GuA	Greenson loam, deep over clay, 0 to 1 percent slopes	38	IIIw-25	101	--------	---	Wet Meadow	116	------	1
GvA	Greenson loam, deep over gravel, 0 to 1 percent slopes	38	IIw-2	97	--------	---	Semiwet Meadow	115	------	1
HdA	Hendricks silt loam, 1 to 3 percent slopes	39	IIc-2	97	IIe-M	96	----------------	---	------	3
HdB	Hendricks silt loam, 3 to 6 percent slopes	39	IIe-2	96	IIe-M	96	----------------	---	------	3
HdC	Hendricks silt loam, 6 to 10 percent slopes	39	IIIe-2	98	IIIe-M	98	----------------	---	------	3
HdD	Hendricks silt loam, 10 to 20 percent slopes	39	IVe-2	102	IVe-M	103	Mountain Loam	112	------	3
HeC	Hiibner gravelly clay loam, 3 to 10 percent slopes	40	-------	---	IIIe-MX5	99	Mountain Stony Clay	113	------	3

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Capability unit Irrigated Page	Capability unit Nonirrigated Symbol	Capability unit Nonirrigated Page	Range site Name	Range site Page	Woodland suitability group Number	Wildlife suitability group Number
HeD	Hiibner gravelly clay loam, 10 to 20 percent slopes	40	-------	---	IVe-MX5	103	Mountain Stony Clay	113	------	3
HeE	Hiibner gravelly clay loam, 20 to 30 percent slopes	41	-------	---	VIe-MX5	105	Mountain Stony Clay	113	------	3
HfE	Hiibner extremely stony clay loam, 1 to 30 percent slopes	40	-------	---	VIIs-MX5	107	Mountain Stony Clay	113	------	3
HgE2	Hillfield silt loam, 20 to 30 percent slopes, eroded	41	-------	---	VIe-U	105	Upland Loam	115	------	2
HhE2	Hillfield-Timpanogos silt loams, 10 to 30 percent slopes, eroded	41	-------	---	VIe-U	105	Upland Loam	115	------	2
HIB	Hoskin gravelly loam, thick surface, 1 to 6 percent slopes	43	-------	---	VIe-M	105	Mountain Loam	112	------	3
HKG2	Hoskin cobbly loam, 30 to 70 percent slopes, eroded	42	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
HLG2	Hoskin-Datwyler association, eroded	42	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
HMG2	Hoskin-Elzinga association, eroded	42								
	Hoskin soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Elzinga soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
HNG	Hoskin-Scave association	43								
	Hoskin soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Scave soil	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Ant Flat soil	--	-------	---	VIe-M	105	Mountain Loam	112	------	3
HOG2	Hoskin-Scout association, eroded	43								
	Hoskin soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Scout soil	--	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
HSG2	Hoskin-Smarts association, eroded	43								
	Hoskin soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Smarts soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
HuC	Hyrum gravelly loam, 4 to 8 percent slopes	44	-------	---	IIIe-UX	100	----------------	---	------	2
HuE	Hyrum gravelly loam, 10 to 25 percent slopes	44	-------	---	IVe-UX	104	Upland Stony Loam	115	------	2
HyC	Hyrum cobbly loam, 4 to 8 percent slopes	44	-------	---	IIIe-UX	100	Upland Stony Loam	115	------	2
Jo	Jordan silty clay loam	45	-------	---	VIIw-285	106	Alkali Bottom	111	------	1
Jr	Jordan-Lasil silty clay loams	44	-------	---	VIIw-285	106	Alkali Bottom	111	------	1
KdA	Kidman fine sandy loam, 0 to 2 percent slopes	46	IIc-2	97	--------	---	-----------------	---	------	2
KdD	Kidman fine sandy loam, 8 to 15 percent slopes	46	IVe-2	102	--------	---	-----------------	---	------	2

GUIDE TO MAPPING UNITS--Continued

			Capability unit				Range site		Woodland suitability group	Wildlife suitability group
			Irrigated		Nonirrigated					
Map symbol	Mapping unit	Page	Symbol	Page	Symbol	Page	Name	Page	Number	Number
KfA	Kidman fine sandy loam, deep water table, 0 to 2 percent slopes	45	IIc-2	97	--------	---	----------------	---	------	2
KfB	Kidman fine sandy loam, deep water table, 2 to 4 percent slopes	46	IIe-2	96	--------	---	----------------	---	------	2
KfC	Kidman fine sandy loam, deep water table, 4 to 8 percent slopes	46	IIIe-2	98	--------	---	----------------	---	------	2
Ks	Kirkham-Shay complex	46	IIw-2	97	--------	---	Semiwet Meadow	115	------	1
Kt	Kirkham-Shay complex, strongly alkali	47	IVw-28	104	--------	---	Alkali Bottom	111	------	1
La	Lakewin gravelly coarse sandy loam	47	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
LCG	LaPlatta silty clay loam, 30 to 50 percent slopes	48	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
LGE	LaPlatta-Obray association	48								
	LaPlatta soil	--	-------	---	VIe-MN	105	Mountain Loam (Shrubs)	112	------	3
	Obray soil	--	-------	---	VIe-M5	105	Mountain Clay	112	------	3
	Barfuss soil	--	-------	---	VIIe-MN	106	----------------	---	------	3
Lh	Layton loamy fine sand	49	IIIs-24	101	--------	---	----------------	---	------	2
LMG2	Leatham-Barfuss association, eroded	50								
	Leatham soil	--	-------	---	VIIe-U	106	Upland Loam	115	------	2
	Barfuss soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
Ln	Lewiston fine sandy loam	51	IIw-26	97	--------	---	----------------	---	------	2
Lo	Lewiston fine sandy loam, strongly alkali	51	IVw-28	104	--------	---	Alkali Bottom	111	------	1
Lr	Logan silty clay loam	51	IIIw-25	101	--------	---	Wet Meadow	116	------	1
LSE	Lucky Star silt loam, 6 to 30 percent slopes	53	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
LTG	Lucky Star gravelly silt loam, 30 to 60 percent slopes	52	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2r1	4
LUE	Lucky Star-Goring association	53								
	Lucky Star soil	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Goring soil	--	-------	---	VIe-M	105	Mountain Loam	112	------	3
LVE	Lucky Star-Hoskin association	53								
	Lucky Star soil	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Hoskin soil	--	-------	---	VIe-M	105	Mountain Stony Loam	114	------	3
LWE	Lucky Star-Red Spur complex, 6 to 30 percent slopes	53	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
LXE	Lucky Star-Scout association	53								
	Lucky Star soil	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Scout soil	--	-------	---	VIe-HC	105	High Mountain Loam (Conifer)	112	4o1	4
MAG	Maughan-Datwyler association	54								
	Maughan soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Datwyler soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
McA	McMurdie silt loam, 0 to 3 percent slopes	55	IIc-2	97	IIe-M	96	----------------	---	------	3

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Page	Capability unit Nonirrigated Symbol	Page	Range site Name	Page	Woodland suitability group Number	Wildlife suitability group Number
McB	McMurdie silt loam, 3 to 6 percent slopes	54	IIe-2	96	IIe-M	96	----------------	---	------	3
McC	McMurdie silt loam, 6 to 10 percent slopes	55	IIIe-2	98	IIIe-M	98	----------------	---	------	3
MdE2	McMurdie-Hillfield silt loams, 10 to 30 percent slopes, eroded	55								
	McMurdie soil	--	-------	---	IVe-M	103	----------------	---	------	3
	Hillfield soil	--	-------	---	VIe-U	105	Upland Loam	115	------	2
MeA	Mendon silt loam, 0 to 3 percent slopes	57	IIc-2	97	IIe-M	96	----------------	---	------	3
MeB	Mendon silt loam, 3 to 6 percent slopes	56	IIe-2	96	IIe-M	96	----------------	---	------	3
MeC	Mendon silt loam, 6 to 10 percent slopes	57	IIIe-2	98	IIIe-M	98	----------------	---	------	3
MfB	Mendon-Collinston complex, 1 to 6 percent slopes	57	-------	---	IIIe-U	99	----------------	---	------	2
MfE2	Mendon-Collinston complex, 6 to 30 percent slopes, eroded	58	-------	---	VIe-U	105	Upland Loam	115	------	2
MlA	Millville silt loam, 0 to 2 percent slopes	60	IIw-2	97	--------	---	----------------	---	------	2
MlB	Millville silt loam, 2 to 4 percent slopes	59	IIe-2	96	--------	---	----------------	---	------	2
Mm	Mixed alluvial land	60	-------	---	Vw-2	104	Wet Meadow	116	------	1
MNE	Mult-Agassiz association	60								
	Mult soil	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2o1	4
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
MNG2	Mult-Agassiz association, eroded	61								
	Mult soil	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2o1	4
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
MoG2	Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded	61								
	Munk soil	--	-------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
	Blackrock soil	--	-------	---	VIIs-U4	107	Upland Loam	115	------	2
MSE	Mult-Lucky Star association	61								
	Mult soil	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Lucky Star soil	--	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
NbB	Nebeker silt loam, 3 to 6 percent slopes	63	IIe-2	96	IIe-M	96	-----------------	---	------	3
NbC	Nebeker silt loam, 6 to 10 percent slopes	63	IIIe-2	98	IIIe-M	98	-----------------	---	------	3
NbE	Nebeker silt loam, 10 to 25 percent slopes	62	-------	---	IVe-M	103	-----------------	---	------	3
NcA	Nibley silty clay loam, 0 to 3 percent slopes	63	IIIw-2	100	--------	---	Semiwet Meadow	115	------	1
NcB	Nibley silty clay loam, 3 to 6 percent slopes	63	IIIw-2	100	--------	---	-----------------	---	------	1
ObB	Obray silty clay, 1 to 6 percent slopes	64	-------	---	VIe-M5	105	Mountain Clay	112	------	3
PaA	Parleys silt loam, 0 to 3 percent slopes	65	IIc-2	97	IIIw-U	99	-----------------	---	------	2
PaB	Parleys silt loam, 3 to 6 percent slopes	65	IIe-2	96	IIIe-U	99	-----------------	---	------	2

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Page	Capability unit Nonirrigated Symbol	Page	Range site Name	Page	Woodland suitability group Number	Wildlife suitability group Number
PaC	Parleys silt loam, 6 to 10 percent slopes	66	IIIe-2	98	IIIe-UE	100	----------------	---	------	2
PlA	Parlo silt loam, 0 to 3 percent slopes	66	IIc-2	97	IIIs-U4	102	----------------	---	------	2
PlB	Parlo silt loam, 3 to 6 percent slopes	66	IIe-2	96	IIIs-U4	102	----------------	---	------	2
PlC	Parlo silt loam, 6 to 10 percent slopes	66	-------	---	IIIe-UE	100	----------------	---	------	2
Pn	Payson silt loam	67	-------	---	VIIw-285	106	Alkali Bottom	111	------	1
POG2	Picayune-Agassiz association, eroded	67								
	Picayune soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
PRG	Picayune-Smarts association	68								
	Picayune soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Smarts soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
PSG2	Poleline-Agassiz association, eroded	69								
	Poleline soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
PtC	Preston fine sand, 0 to 10 percent slopes	69	IVs-24	104	--------	---	----------------	---	------	2
Pu	Provo loam	70	IIIw-2	100	--------	---	Wet Meadow	116	------	1
Pv	Provo gravelly loam	70	-------	---	Vw-2	104	Wet Meadow	116	------	1
Qu	Quinney silt loam	70	IIIw-28	101	--------	---	Alkali Bottom	111	------	1
RCG2	Richmond very stony loam, 30 to 70 percent slopes, eroded	72	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
RDG2	Richmond-Middle association, eroded	72								
	Richmond soil	--	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
	Middle soil	--	-------	---	VIIs-U4	107	Upland Loam	115	------	2
REG2	Richmond-Munk association, eroded	72								
	Richmond soil	--	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
	Munk soil	--	-------	---	VIIs-U4	107	Upland Stony Loam	115		2
RFG2	Richmond-Nebeker association, eroded	73								
	Richmond soil	--	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
	Nebeker soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
	Sterling soil	--	-------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
RGG2	Richmond-Sterling association, eroded	73								
	Richmond soil	--	-------	---	VIIs-UX3	107	Upland Shallow Loam	115	------	2
	Sterling soil	--	------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
RhA	Ricks gravelly loam, 0 to 3 percent slopes	74	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
RhB	Ricks gravelly loam, 3 to 6 percent slopes	74	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
RhC	Ricks gravelly loam, 6 to 10 percent slopes	74	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
Rk	Riverwash	74	-------	---	VIIIw-4	107	----------------	---	------	---
RO	Rock land	74	-------	---	VIIIs-X	107	----------------	---	------	---
Rs	Roshe Springs silt loam	75	IIIw-2	100	--------	---	Wet Meadow	116	------	1
Rt	Rough broken land	76	-------	---	VIIe-U	106	Upland Loam	115	------	2

GUIDE TO MAPPING UNITS--Continued

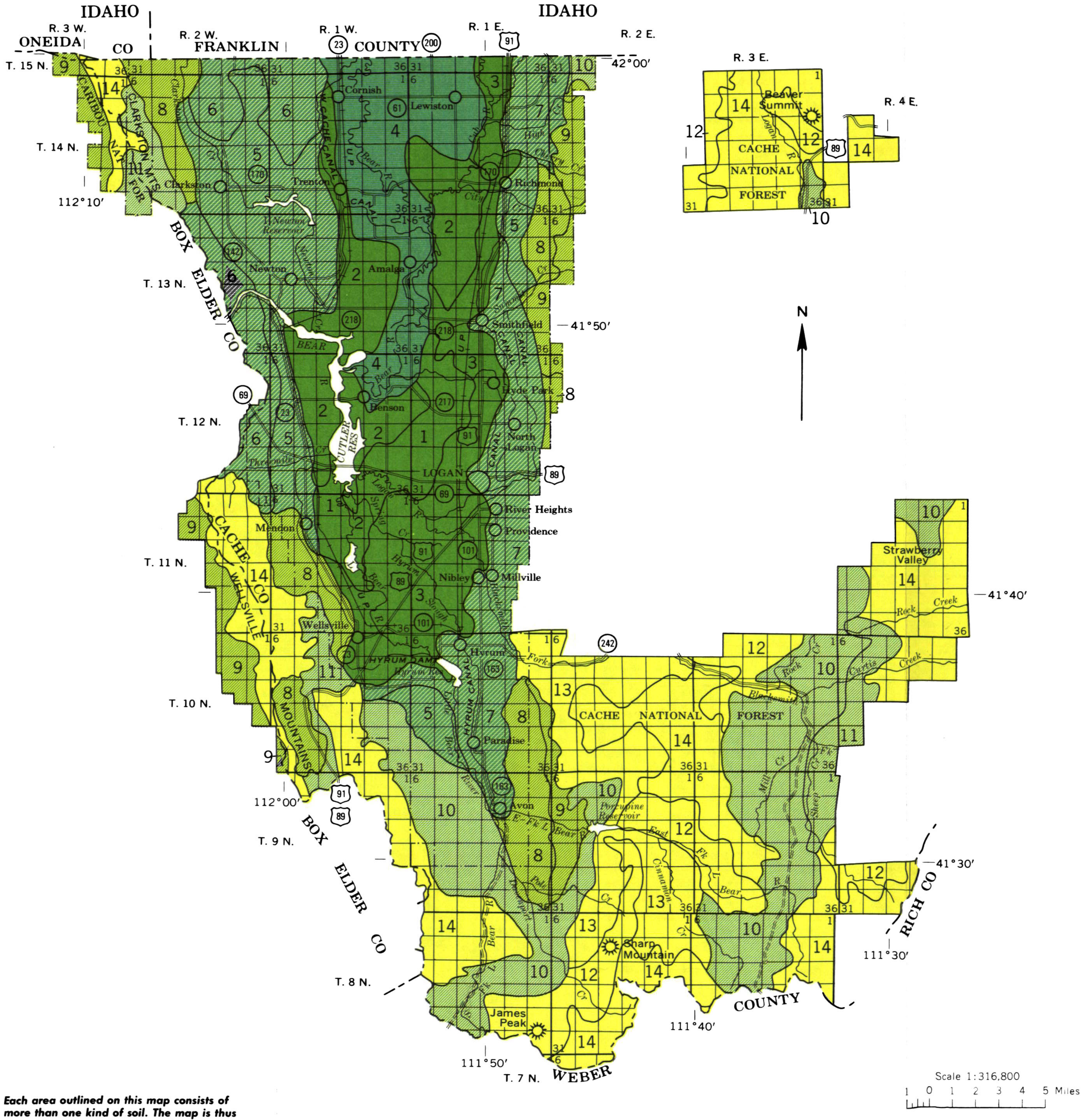
Map symbol	Mapping unit	Page	Capability unit Irrigated Symbol	Page	Capability unit Nonirrigated Symbol	Page	Range site Name	Page	Woodland suitability group Number	Wildlife suitability group Number
SAG	St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes	76	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
SCG	St. Marys-Curtis Creek association	77								
	St. Marys soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Curtis Creek soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
Sd	Salt Lake silty clay loam	77	IIIw-25	101	--------	---	Wet Meadow	116	------	1
Se	Salt Lake silty clay	77	-------	---	Vw-2	104	Wet Meadow	116	------	1
Sf	Salt Lake-Logan complex	78	IIIw-25	101	--------	---	Wet Meadow	116	------	1
Sg	Salt Lake-Roshe Springs complex	78	-------	---	Vw-2	104	Wet Meadow	116	------	1
Sh	Salt Lake-Trenton complex	78	-------	---	--------	---	----------------	---	------	---
	Salt Lake soil	--	-------	---	Vw-2	104	Wet Meadow	116	------	1
	Trenton soil	--	-------	---	Vw-2	104	Alkali Bottom	111	------	1
SIE	Scave silt loam, 10 to 30 percent slopes	78	-------	---	VIe-HA	104	High Mountain Loam (Aspen)	111	2o1	4
SKE	Scave extremely rocky silt loam, 10 to 30 percent slopes	79	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	------	4
SLG	Scout gravelly loam, 40 to 70 percent slopes	80	-------	---	VIIe-HC	106	High Mountain Loam (Conifer)	112	4r1	4
Sm	Shay silty clay loam	80	IIIw-25	101	--------	---	Semiwet Meadow	115	------	1
SNG2	Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded	81	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
SOG2	Sheep Creek-Agassiz association, eroded	81								
	Sheep Creek soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Agassiz soil	--	-------	---	VIIs-MX3	107	Mountain Shallow Loam	113	------	3
SPG2	Sheep Creek-Despain association, eroded	81								
	Sheep Creek soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Despain soil	--	-------	---	VIIe-M	106	Mountain Loam	112	------	3
SRG2	Sheep Creek-Maughan association, eroded	81								
	Sheep Creek soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
	Maughan soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
SSE	Smarts silt loam, 10 to 30 percent slopes	82	-------	---	VIe-M	105	Mountain Loam (Shrubs)	112	------	3
STG2	Smarts-Hoskin association, eroded	82								
	Smarts soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Haskins soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit: Irrigated Symbol	Page	Capability unit: Nonirrigated Symbol	Page	Range site: Name	Page	Woodland suitability group: Number	Wildlife suitability group: Number
SUG	Smarts-Lucky Star-Poleline association	83								
	Smarts soil	--	-------	---	VIIe-MN	106	Mountain Loam (Shrubs)	112	------	3
	Lucky Star soil	--	-------	---	VIIe-HA	106	High Mountain Loam (Aspen)	111	2r1	4
	Poleline soil	--	-------	---	VIIe-M4	106	Mountain Stony Loam	114	------	3
SvA	Steed gravelly loam, 0 to 3 percent slopes	84	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SvB	Steed gravelly loam, 3 to 6 percent slopes	84	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SvC	Steed gravelly loam, 6 to 10 percent slopes	84	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SwC	Sterling gravelly loam, 6 to 10 percent slopes	85	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SwD	Sterling gravelly loam, 10 to 20 percent slopes	85	IVs-24	104	VIs-U4	105	Upland Stony Loam	115	------	2
SwF2	Sterling gravelly loam, 20 to 50 percent slopes, eroded	85	-------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
Sy	Stony alluvial land	85	-------	---	VIIs-U4	107	Upland Stony Loam	115	------	2
TmA	Timpanogos silt loam, 0 to 3 percent slopes	86	IIc-2	97	IIIe-U	99	-----------------	---	------	2
TmB	Timpanogos silt loam, 3 to 6 percent slopes	86	IIe-2	96	IIIe-U	99	-----------------	---	------	2
TmC	Timpanogos silt loam, 6 to 10 percent slopes	86	IIIe-2	98	IIIe-UE	100	-----------------	---	------	2
TmD2	Timpanogos silt loam, 10 to 20 percent slopes, eroded	86	IVe-2	102	IVe-U	103	Upland Loam	115	------	2
TnA	Timpanogos silt loam, deep water table, 0 to 3 percent slopes	87	IIc-2	97	--------	---	-----------------	---	------	2
TrA	Trenton silty clay loam, 0 to 2 percent slopes	87	IVw-28	104	IIIs-U8	102	Alkali Bottom	111	------	1
TrB	Trenton silty clay loam, 2 to 4 percent slopes	88	IVw-28	104	IIIs-U8	102	Alkali Bottom	111	------	1
TrC	Trenton silty clay loam, 4 to 8 percent slopes	88	IVw-28	104	IIIs-U8	102	Alkali Bottom	111	------	1
TrD2	Trenton silty clay loam, 8 to 20 percent slopes, eroded	88	-------	---	IVe-U8	103	Alkali Bottom	111	------	1
TtA	Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes	88	IVw-28	104	--------	---	Alkali Bottom	111	------	1
WhE	Wheelon silt loam, 10 to 30 percent slopes	89	-------	---	VIe-U1	105	Upland Shallow Loam	115	------	2
WhF2	Wheelon silt loam, 30 to 50 percent slopes, eroded	89	-------	---	VIIe-U1	106	Upland Shallow Loam	115	------	2
W1E2	Wheelon-Collinston complex, 10 to 30 percent slopes, eroded	89								
	Wheelon soil	--	-------	---	VIe-U1	105	Upland Shallow Loam	115	------	2
	Collinston soil	--	-------	---	VIe-U1	105	Upland Loam	115	------	2
Wn	Winn silt loam	89	IIIw-2	100	--------	---	Semiwet Meadow	115	------	1
Wp	Winn-Provo complex	90	IIIw-2	100	--------	---	Semiwet Meadow	115	------	1
Wr	Woods Cross silty clay loam	90	IIIw-25	101	--------	---	Wet Meadow	116	------	1

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit: Irrigated Symbol	Irrigated Page	Capability unit: Nonirrigated Symbol	Nonirrigated Page	Range site: Name	Range site: Page	Woodland suitability group: Number	Wildlife suitability group: Number
YHE	Yeates Hollow extremely rocky silt loam, 6 to 30 percent slopes	91	-------	---	VIIs-MX4	107	Mountain Stony Loam	114	------	3
YHG	Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes	91	-------	---	VIIs-MX4	107	Mountain Stony Loam	114	------	3
YLE2	Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded	92	-------	---	VIIs-MX5	107	Mountain Stony Clay	113	------	3



SOIL ASSOCIATIONS

MODERATELY WELL DRAINED TO POORLY DRAINED SOILS OF THE LOW LAKE TERRACES

1 Logan-Salt Lake association: Poorly drained, nearly level soils that have a silty clay loam and silty clay underlying layer

2 Trenton association: Strongly saline and alkali, somewhat poorly drained and moderately well drained, nearly level to sloping soils that have a silty clay subsoil

3 Greenson-Nibley-Collett association: Dominantly somewhat poorly drained, nearly level to gently sloping soils that have a loam to silty clay subsoil or underlying layer

WELL-DRAINED TO SOMEWHAT POORLY DRAINED SOILS OF THE MEDIUM LAKE TERRACES

4 Kidman-Lewiston association: Nearly level to gently sloping soils that are fine sandy loam throughout

WELL-DRAINED SOILS OF THE MEDIUM AND HIGH LAKE TERRACES

5 Mendon-Avon association: Nearly level to strongly sloping soils that have a clay loam and silty clay subsoil

6 Wheelon-Collinston association: Moderately steep to very steep soils that have a loam, silt loam, and clay loam underlying layer

7 Ricks-Timpanogos-Parleys association: Nearly level and strongly sloping soils that have a gravelly loam, gravelly sandy loam, loam, and clay loam subsoil

WELL-DRAINED SOILS OF THE UPLANDS

8 Nebeker-Hendricks association: Strongly sloping to moderately steep soils that have a silty clay loam and clay subsoil

9 Richmond-Sterling-Picayune association: Somewhat excessively drained soils that have gravelly loam or gravelly sandy loam underlying layers or a gravelly clay loam subsoil

WELL-DRAINED AND SOMEWHAT EXCESSIVELY DRAINED SOILS OF THE MOUNTAINS

10 Yeates Hollow-Ant Flat-Goring association: Sloping to very steep soils that have a silty clay, clay, and very cobbly clay subsoil

11 Sheep Creek-Hoskin-Curtis Creek association: Steep and very steep soils that have a gravelly and cobbly loam to clay loam subsoil

WELL-DRAINED AND SOMEWHAT EXCESSIVELY DRAINED SOILS OF THE HIGH MOUNTAINS

12 Agassiz-Rock outcrops association: Very steep, stony soils that are silt loam and stony silty clay loam throughout, and rock outcrops

13 Dateman-Agassiz-Bradshaw association: Steep and very steep soils that are cobbly or very cobbly silt loam and silty clay loam throughout or have a cobbly loam subsoil

14 Lucky Star-Cluff-Bickmore association: Moderately steep and steep soils that have a very cobbly sandy clay loam, gravelly clay, and cobbly silty clay loam subsoil

Compiled 1971

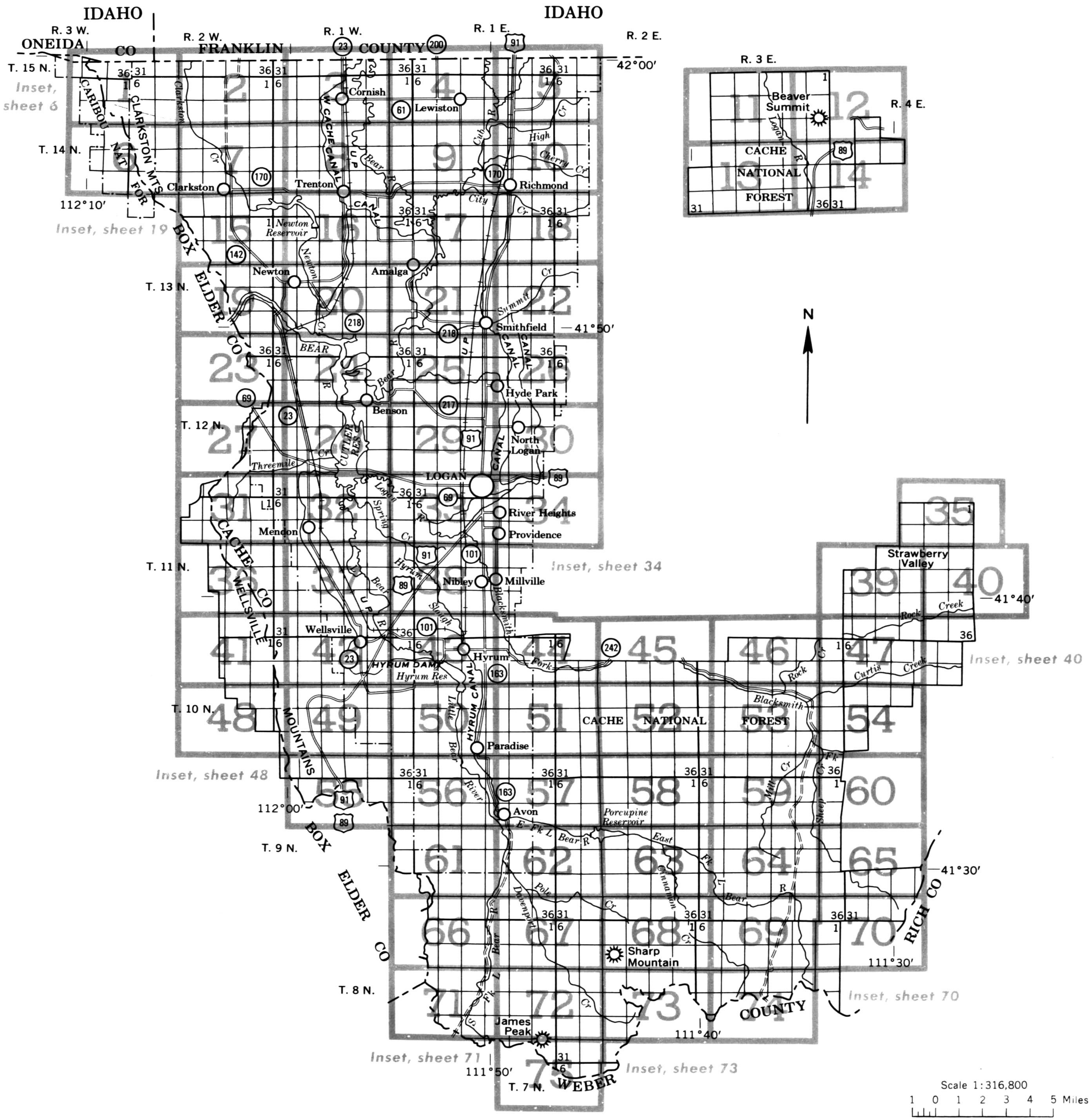
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

UTAH AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

CACHE VALLEY AREA, UTAH
PARTS OF CACHE AND BOX ELDER COUNTIES

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

CACHE VALLEY AREA, UTAH
PARTS OF CACHE AND BOX ELDER COUNTIES

U. S. DEPARTMENT OF AGRICULTURE
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CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES

SOIL LEGEND

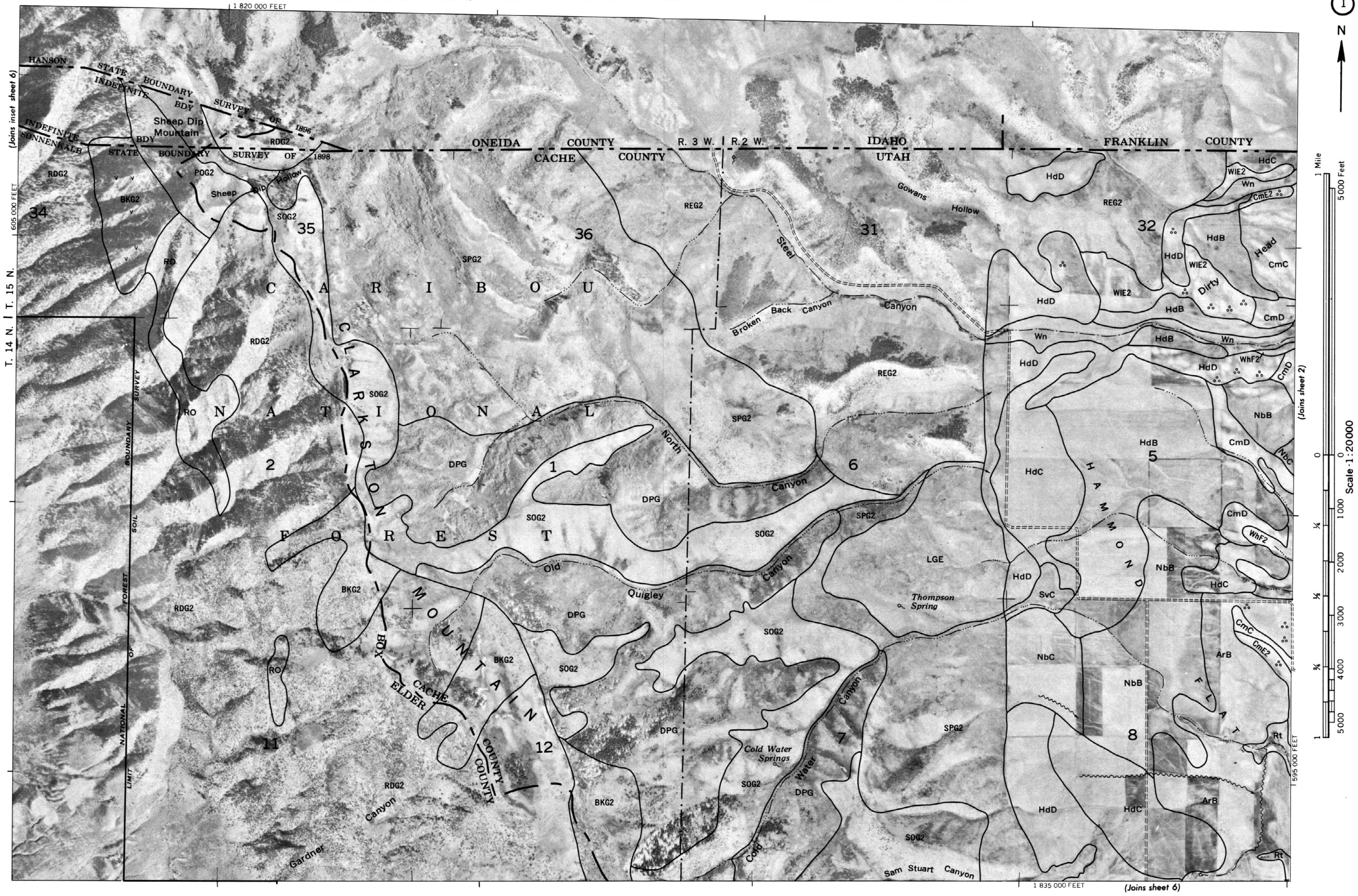
The first letter, always a capital, is the initial one of the soil name. The second letter is a capital if the mapping unit is one of the low intensity survey *; otherwise, it is a small letter. The third letter, always a capital, A, B, C, D, E, F, or G, shows the slope. Most symbols without a slope letter are those of nearly level soils, but some are for land types that have a considerable range of slope. A final number, 2, in the symbol shows that the soil is eroded.

SYMBOL		NAME
HIGH AND MEDIUM INTENSITY	LOW INTENSITY	
–	AAE	Agassiz rocky silt loam, 6 to 30 percent slopes
–	AAG2	Agassiz rocky silt loam, 30 to 70 percent slopes, eroded
–	ABG2	Agassiz-Bradshaw association, eroded
–	ADG2	Agassiz-Dateman association, eroded
–	AEG2	Agassiz-Elwood association, eroded
–	AGE	Agassiz-Goring association
–	AGG2	Agassiz-Goring association, eroded
AhA	–	Airport silt loam, 0 to 3 percent slopes
Ak	–	Airport silty clay loam
Am	–	Airport-Salt Lake complex
–	AND	Ant Flat loam, 6 to 20 percent slopes
–	AOE2	Ant Flat-Despain association, eroded
ArA	–	Avon silty clay loam, 0 to 3 percent slopes
ArB	–	Avon silty clay loam, 3 to 6 percent slopes
ArC	–	Avon silty clay loam, 6 to 10 percent slopes
ArD	–	Avon silty clay loam, 10 to 20 percent slopes
AsC	–	Avon-Collinston complex, 6 to 10 percent slopes
AsE	–	Avon-Collinston complex, 10 to 30 percent slopes
–	BAF	Barfuss-Leatham association
BcA	–	Battle Creek silty clay loam, 0 to 2 percent slopes
BcD	–	Battle Creek silty clay loam, 8 to 15 percent slopes
–	BGG	Bickmore gravelly silt loam, 30 to 70 percent slopes
–	BKG2	Bickmore-Agassiz association, eroded
–	BLG2	Bickmore-Sheep Creek association, eroded
BmB	–	Blackrock gravelly loam, 3 to 6 percent slopes
BmC	–	Blackrock gravelly loam, 6 to 10 percent slopes
BmD	–	Blackrock gravelly loam, 10 to 20 percent slopes
BnD	–	Blackrock extremely stony loam, 10 to 20 percent slopes
–	BSG2	Bradshaw-Agassiz association, eroded
Ca	–	Cache silty clay
Cd	–	Cardon silty clay
–	CE	Center Creek silt loam
–	CFE	Clegg silt loam, 20 to 30 percent slopes
–	CGE	Cluff silt loam, 6 to 30 percent slopes
–	CHE	Cluff-Lucky Star association
–	CIE	Cluff-Scout association
Ck	–	Collett silty clay loam
ClA	–	Collinston loamy fine sand, 0 to 3 percent slopes
CmC	–	Collinston loam, 1 to 6 percent slopes
CmD	–	Collinston loam, 6 to 10 percent slopes
CmE2	–	Collinston loam, 10 to 30 percent slopes; eroded
CoA	–	Crookston loam, 0 to 3 percent slopes
CoB	–	Crookston loam, 3 to 6 percent slopes
CoC	–	Crookston loam, 6 to 10 percent slopes
CrB	–	Crowshaw gravelly loam, 3 to 6 percent slopes
CrC	–	Crowshaw gravelly loam, 6 to 10 percent slopes
CrD	–	Crowshaw gravelly loam, 10 to 20 percent slopes
–	CSE	Curtis Creek-Goring association, hilly
–	CSG	Curtis Creek-Goring association, steep
DaC	–	Dagor silt loam, 4 to 8 percent slopes
DaD	–	Dagor silt loam, 10 to 20 percent slopes
–	DEG	Dateman extremely rocky silt loam, 40 to 80 percent slopes
–	DHG	Dateman-Bradshaw association
–	DLG	Datwyler cobbly silty clay loam, 30 to 60 percent slopes
–	DNG	Datwyler-Elzinga-Maughan association
–	DPG	Despain-Bickmore association
–	DSG	Despain-Lucky Star association
–	EDG	Elwood silt loam, 30 to 60 percent slopes
–	EGE	Elwood-Agassiz association
–	EME	Elwood-Mult association, hilly
–	EMG	Elwood-Mult association, steep
–	FGD	Fitzgerald extremely stony loam, 10 to 20 percent slopes
–	FLD	Flygare silt loam, 3 to 20 percent slopes
–	FOG	Foxol rocky loam, 30 to 60 percent slopes
–	GGE	Goring silt loam, 6 to 30 percent slopes
–	GOE2	Goring-Obray association, eroded
Gp	–	Gravel pit
GrA	–	Green Canyon gravelly loam, 0 to 3 percent slopes
GrB	–	Green Canyon gravelly loam, 3 to 7 percent slopes
GsA	–	Greenson loam, 0 to 3 percent slopes
GsB	–	Greenson loam, 3 to 6 percent slopes
GsC	–	Greenson loam, 6 to 10 percent slopes
GuA	–	Greenson loam, deep over clay, 0 to 1 percent slopes
GvA	–	Greenson loam, deep over gravel, 0 to 1 percent slopes
HdA	–	Hendricks silt loam, 1 to 3 percent slopes
HdB	–	Hendricks silt loam, 3 to 6 percent slopes
HdC	–	Hendricks silt loam, 6 to 10 percent slopes
HdD	–	Hendricks silt loam, 10 to 20 percent slopes
HeC	–	Hiibner gravelly clay loam, 3 to 10 percent slopes
HeD	–	Hiibner gravelly clay loam, 10 to 20 percent slopes
HeE	–	Hiibner gravelly clay loam, 20 to 30 percent slopes
HfE	–	Hiibner extremely stony clay loam, 1 to 30 percent slopes
HgE2	–	Hillfield silt loam, 20 to 30 percent slopes, eroded
HhE2	–	Hillfield-Timpanogos silt loams, 10 to 30 percent slopes, eroded
–	HIB	Hoskin gravelly loam, thick surface, 1 to 6 percent slopes
–	HKG2	Hoskin cobbly loam, 30 to 70 percent slopes, eroded
–	HLG2	Hoskin-Datwyler association, eroded
–	HMG2	Hoskin-Elzinga association, eroded
–	HNG	Hoskin-Scave association
–	HOG2	Hoskin-Scout association, eroded
–	HSG2	Hoskin-Smarts association, eroded
HuC	–	Hyrum gravelly loam, 4 to 8 percent slopes
HuE	–	Hyrum gravelly loam, 10 to 25 percent slopes
HyC	–	Hyrum cobbly loam, 4 to 8 percent slopes
Jo	–	Jordan silty clay loam
Jr	–	Jordan-Lasil silty clay loams
KdA	–	Kidman fine sandy loam, 0 to 2 percent slopes
KdD	–	Kidman fine sandy loam, 8 to 15 percent slopes
KfA	–	Kidman fine sandy loam, deep water table, 0 to 2 percent slopes
KfB	–	Kidman fine sandy loam, deep water table, 2 to 4 percent slopes
KfC	–	Kidman fine sandy loam, deep water table, 4 to 8 percent slopes
Ks	–	Kirkham-Shay complex
Kt	–	Kirkham-Shay complex, strongly alkali
La	–	Lakewin gravelly coarse sandy loam
–	LCG	LaPlatta silty clay loam, 30 to 50 percent slopes
–	LGE	LaPlatta-Obray association
Lh	–	Layton loamy fine sand
–	LMG2	Leatham-Barfuss association, eroded
Ln	–	Lewiston fine sandy loam
Lo	–	Lewiston fine sandy loam, strongly alkali
Lr	–	Logan silty clay loam
–	LSE	Lucky Star silt loam, 6 to 30 percent slopes
–	LTG	Lucky Star gravelly silt loam, 30 to 60 percent slopes
–	LUE	Lucky Star-Goring association
–	LVE	Lucky Star-Hoskin association
–	LWE	Lucky Star-Red Spur complex, 6 to 30 percent slopes
–	LXE	Lucky Star-Scout association
–	MAG	Maughan-Datwyler association
McA	–	McMurdie silt loam, 0 to 3 percent slopes
McB	–	McMurdie silt loam, 3 to 6 percent slopes
McC	–	McMurdie silt loam, 6 to 10 percent slopes
MdE2	–	McMurdie-Hillfield silt loams, 10 to 30 percent slopes, eroded
MeA	–	Mendon silt loam, 0 to 3 percent slopes
MeB	–	Mendon silt loam, 3 to 6 percent slopes
MeC	–	Mendon silt loam, 6 to 10 percent slopes
MfB	–	Mendon-Collinston complex, 1 to 6 percent slopes
MfE2	–	Mendon-Collinston complex, 6 to 30 percent slopes, eroded
MlA	–	Millville silt loam, 0 to 2 percent slopes
MlB	–	Millville silt loam, 2 to 4 percent slopes
Mm	–	Mixed alluvial land
–	MNE	Mult-Agassiz association
–	MNG2	Mult-Agassiz association, eroded
MoG2	–	Munk-Blackrock gravelly loams, 30 to 70 percent slopes, eroded
–	MSE	Mult-Lucky Star association
NbB	–	Nebeker silt loam, 3 to 6 percent slopes
NbC	–	Nebeker silt loam, 6 to 10 percent slopes
NbE	–	Nebeker silt loam, 10 to 25 percent slopes
NcA	–	Nibley silty clay loam, 0 to 3 percent slopes
NcB	–	Nibley silty clay loam, 3 to 6 percent slopes
ObB	–	Obray silty clay, 1 to 6 percent slopes
PaA	–	Parleys silt loam, 0 to 3 percent slopes
PaB	–	Parleys silt loam, 3 to 6 percent slopes
PaC	–	Parleys silt loam, 6 to 10 percent slopes
PlA	–	Parlo silt loam, 0 to 3 percent slopes
PlB	–	Parlo silt loam, 3 to 6 percent slopes
PlC	–	Parlo silt loam, 6 to 10 percent slopes
Pn	–	Payson silt loam
–	POG2	Picayune-Agassiz association, eroded
–	PRG	Picayune-Smarts association
–	PSG2	Poleline-Agassiz association, eroded
PtC	–	Preston fine sand, 0 to 10 percent slopes
Pu	–	Provo loam
Pv	–	Provo gravelly loam
Qu	–	Quinney silt loam
–	RCG2	Richmond very stony loam, 30 to 70 percent slopes, eroded
–	RDG2	Richmond-Middle association, eroded
–	REG2	Richmond-Munk association, eroded
–	RFG2	Richmond-Nebeker association, eroded
–	RGG2	Richmond-Sterling association, eroded
RhA	–	Ricks gravelly loam, 0 to 3 percent slopes
RhB	–	Ricks gravelly loam, 3 to 6 percent slopes
RhC	–	Ricks gravelly loam, 6 to 10 percent slopes
Rk	–	Riverwash
–	RO	Rock land
Rs	–	Roshe Springs silt loam
Rt	–	Rough broken land
–	SAG	St. Marys gravelly very fine sandy loam, 30 to 60 percent slopes
–	SCG	St. Marys-Curtis Creek association
Sd	–	Salt Lake silty clay loam
Se	–	Salt Lake silty clay
Sf	–	Salt Lake-Logan complex
Sg	–	Salt Lake-Roshe Springs complex
Sh	–	Salt Lake-Trenton complex
–	SIE	Scave silt loam, 10 to 30 percent slopes
–	SKE	Scave extremely rocky silt loam, 10 to 30 percent slopes
–	SLG	Scout gravelly loam, 40 to 70 percent slopes
Sm	–	Shay silty clay loam
–	SNG2	Sheep Creek cobbly loam, 30 to 70 percent slopes, eroded
–	SOG2	Sheep Creek-Agassiz association, eroded
–	SPG2	Sheep Creek-Despain association, eroded
–	SRG2	Sheep Creek-Maughan association, eroded
–	SSE	Smarts silt loam, 10 to 30 percent slopes
–	STG2	Smarts-Hoskin association, eroded
–	SUG	Smarts-Lucky Star-Poleline association
SvA	–	Steed gravelly loam, 0 to 3 percent slopes
SvB	–	Steed gravelly loam, 3 to 6 percent slopes
SvC	–	Steed gravelly loam, 6 to 10 percent slopes
SwC	–	Sterling gravelly loam, 6 to 10 percent slopes
SwD	–	Sterling gravelly loam, 10 to 20 percent slopes
SwF2	–	Sterling gravelly loam, 20 to 50 percent slopes, eroded
Sy	–	Stony alluvial land
TmA	–	Timpanogos silt loam, 0 to 3 percent slopes
TmB	–	Timpanogos silt loam, 3 to 6 percent slopes
TmC	–	Timpanogos silt loam, 6 to 10 percent slopes
TmD2	–	Timpanogos silt loam, 10 to 20 percent slopes, eroded
TnA	–	Timpanogos silt loam, deep water table, 0 to 3 percent slopes
TrA	–	Trenton silty clay loam, 0 to 2 percent slopes
TrB	–	Trenton silty clay loam, 2 to 4 percent slopes
TrC	–	Trenton silty clay loam, 4 to 8 percent slopes
TrD2	–	Trenton silty clay loam, 8 to 20 percent slopes, eroded
TtA	–	Trenton silty clay loam, moderately deep water table, 0 to 2 percent slopes
WhE	–	Wheelon silt loam, 10 to 30 percent slopes
WhF2	–	Wheelon silt loam, 30 to 50 percent slopes, eroded
WlE2	–	Wheelon-Collinston complex, 10 to 30 percent slopes, eroded
Wn	–	Winn silt loam
Wp	–	Winn-Provo complex
Wr	–	Woods Cross silty clay loam
–	YHE	Yeates Hollow extremely rocky silt loam, 6 to 30 percent slopes
–	YHG	Yeates Hollow extremely rocky silt loam, 30 to 70 percent slopes
–	YLE2	Yeates Hollow extremely stony silty clay loam, 3 to 30 percent slopes, eroded

* The composition of these units is more variable than that of the others in the survey area but has been controlled well enough to interpret for the expected use of the soils.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 1

①

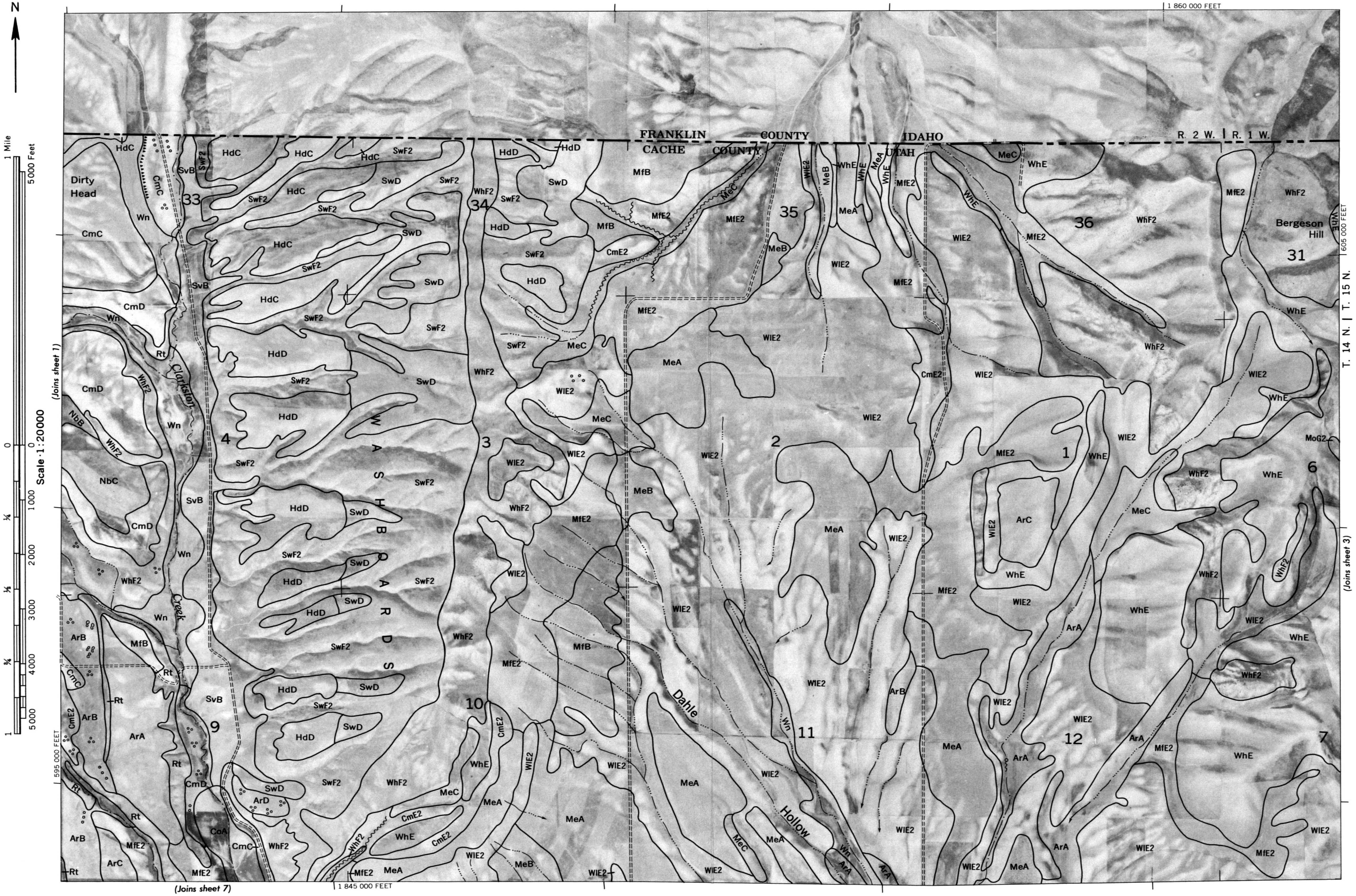


This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 1

②

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 2



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 2

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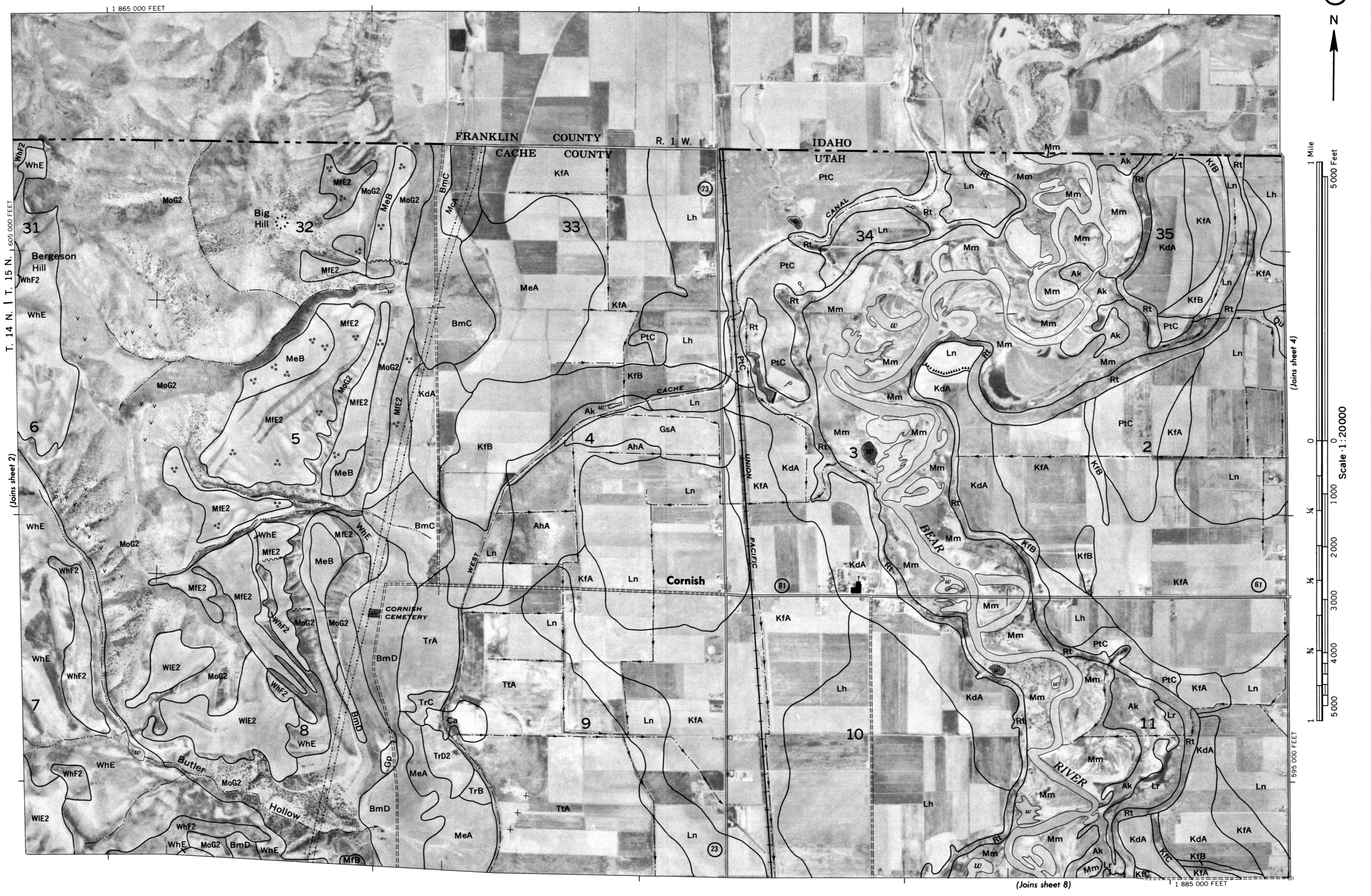
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 3

③



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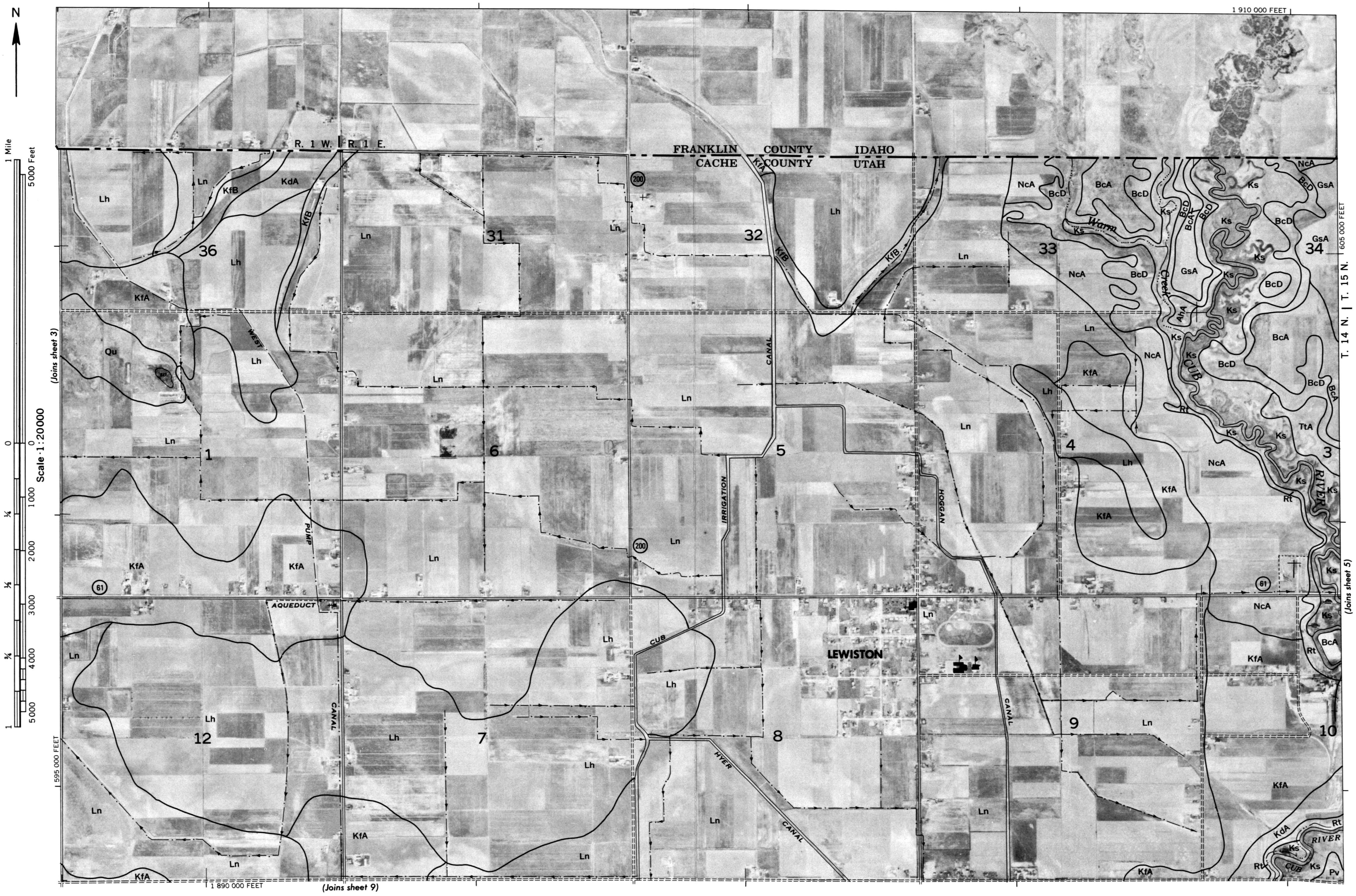
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 3

④

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 4



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 4

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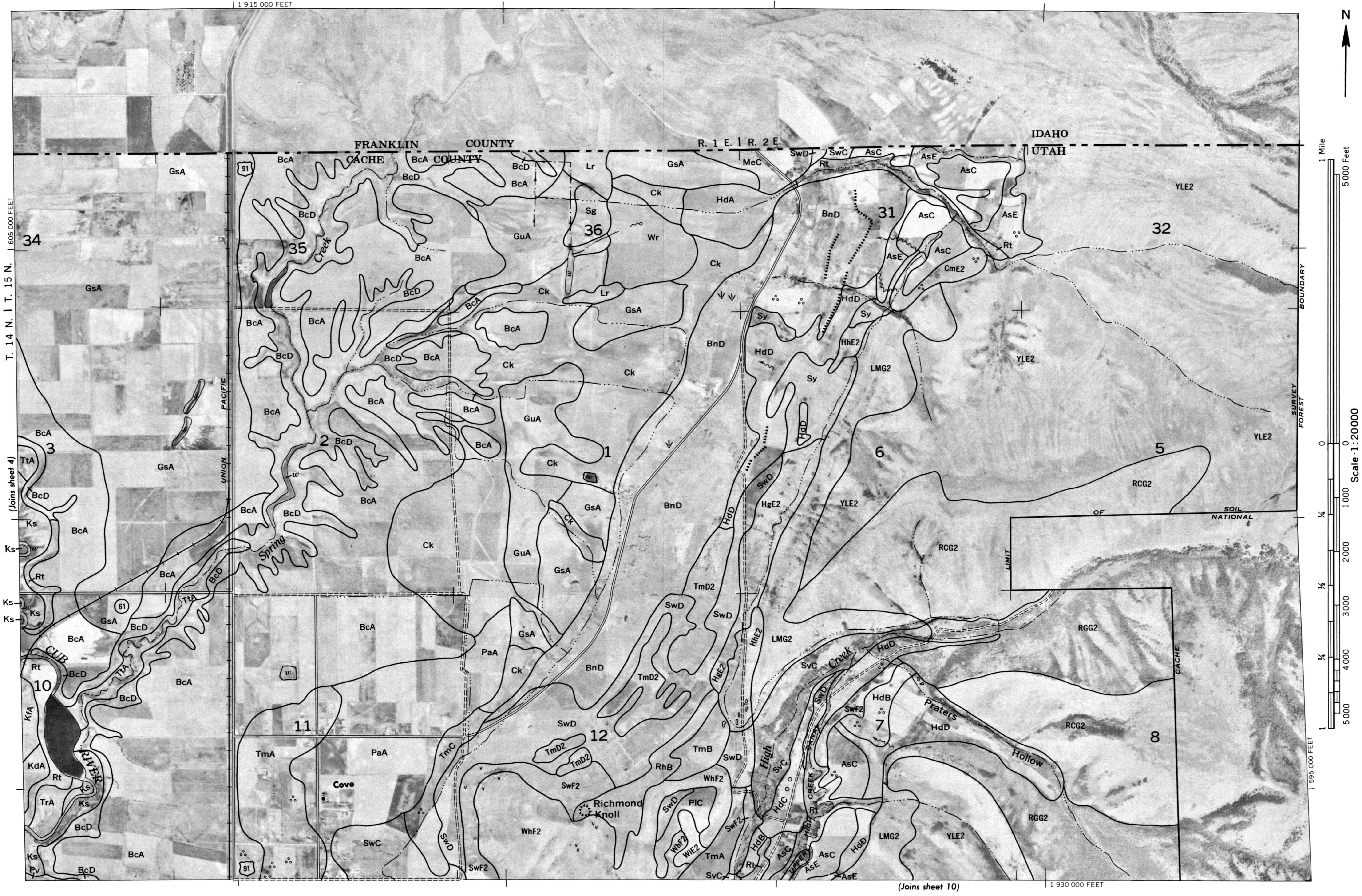
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 5



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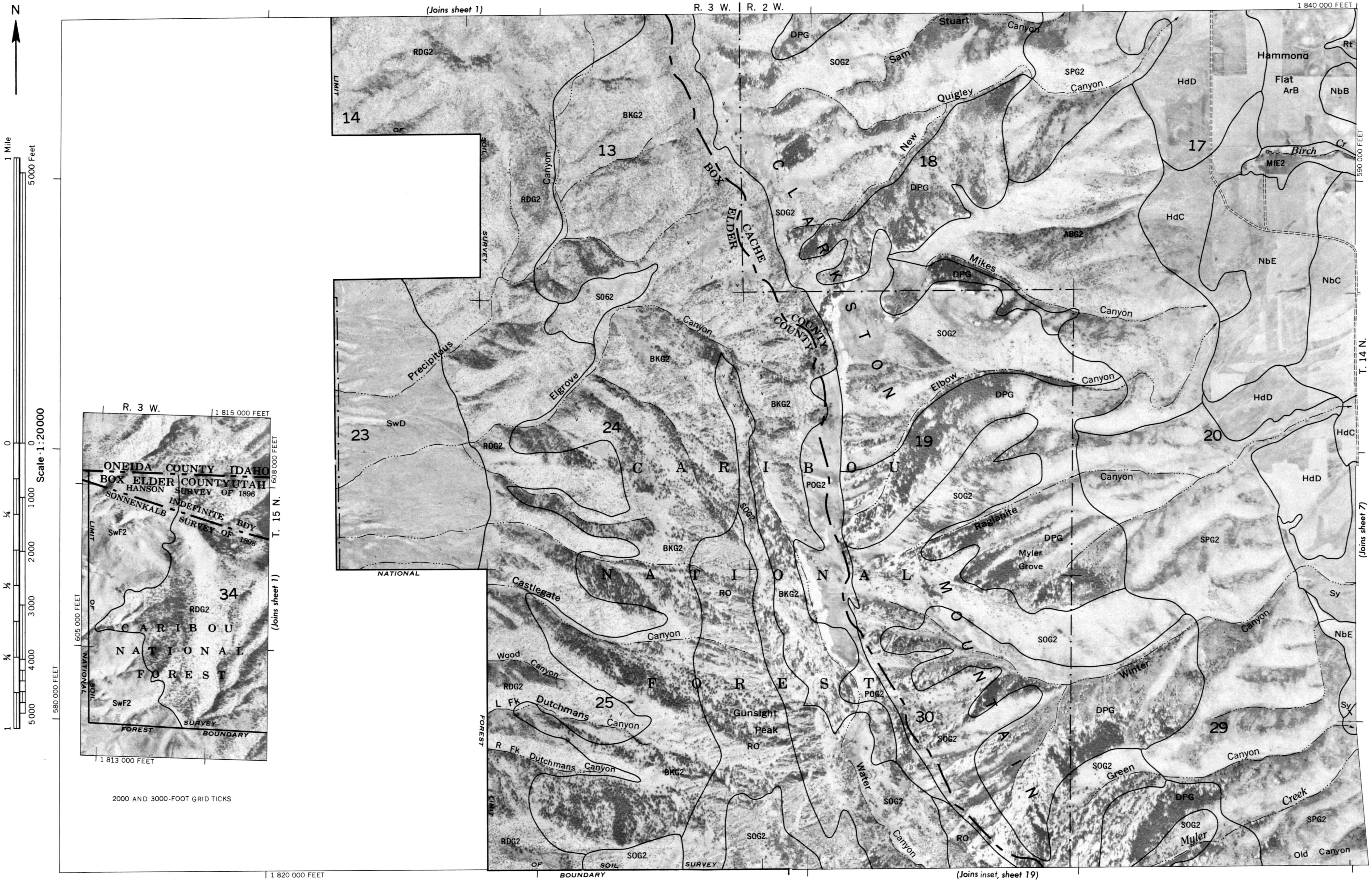
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 5

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 6



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 6

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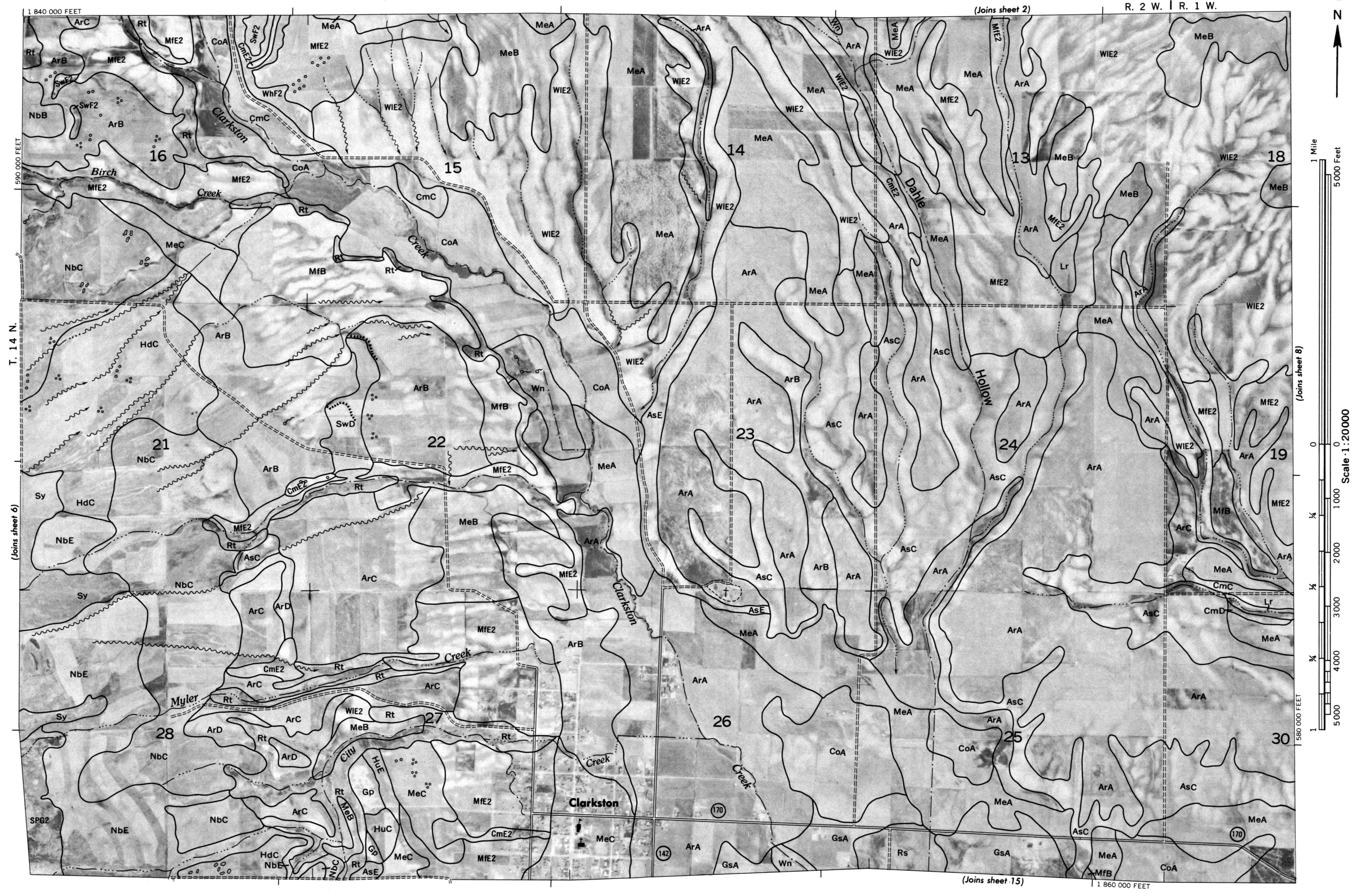
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 7

⑦



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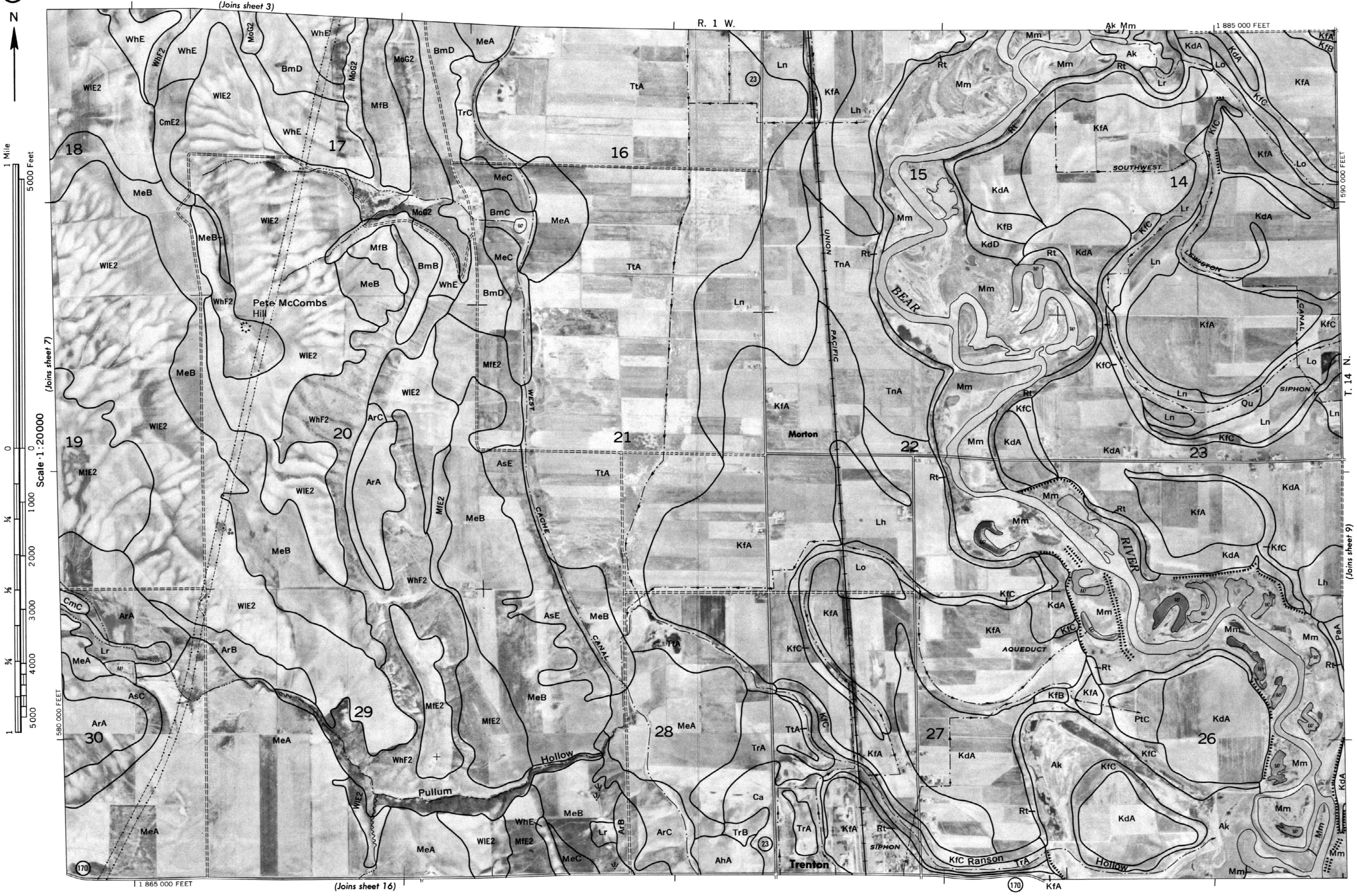
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 7

⑧

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 8



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 8

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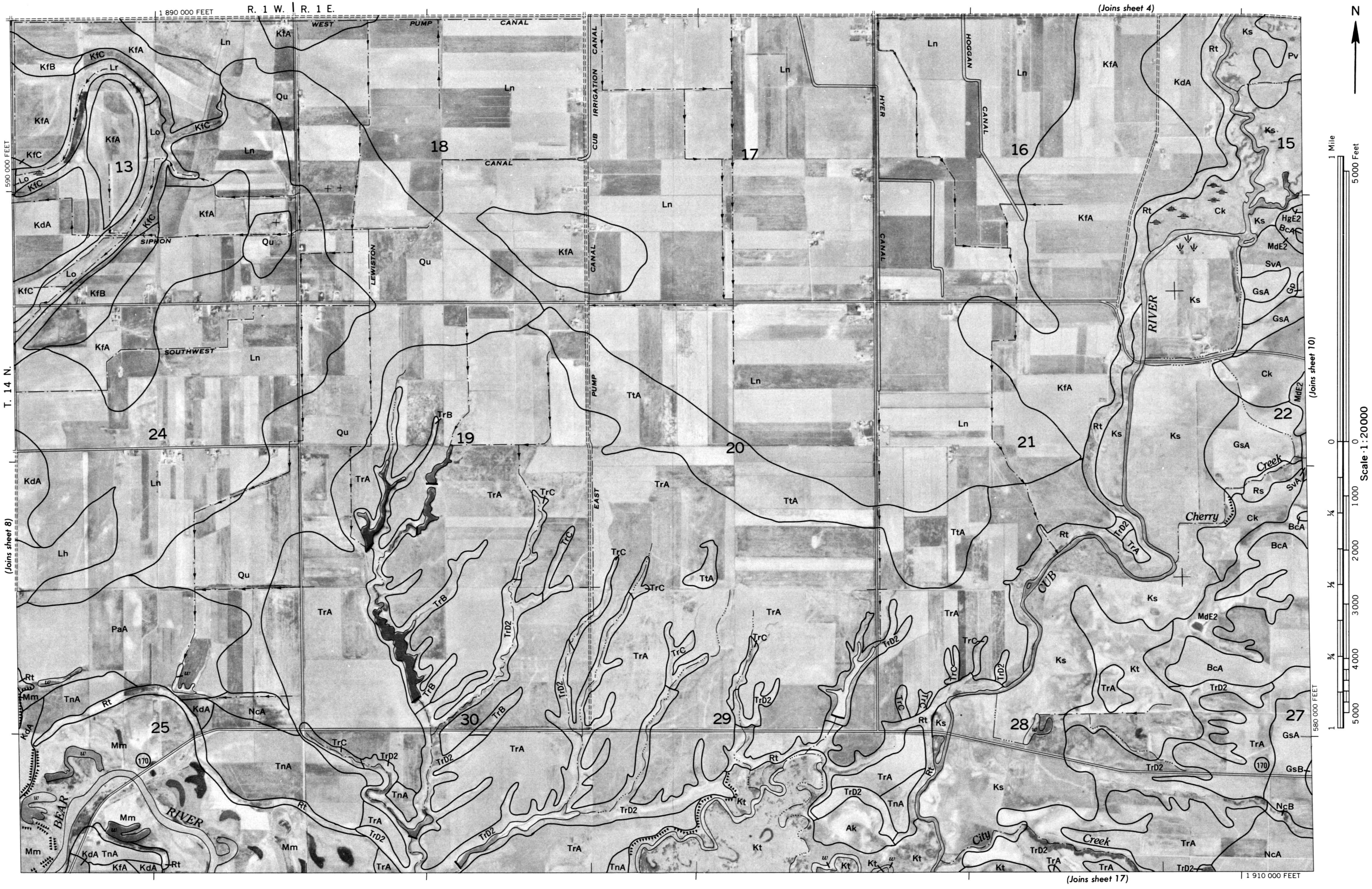
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 9



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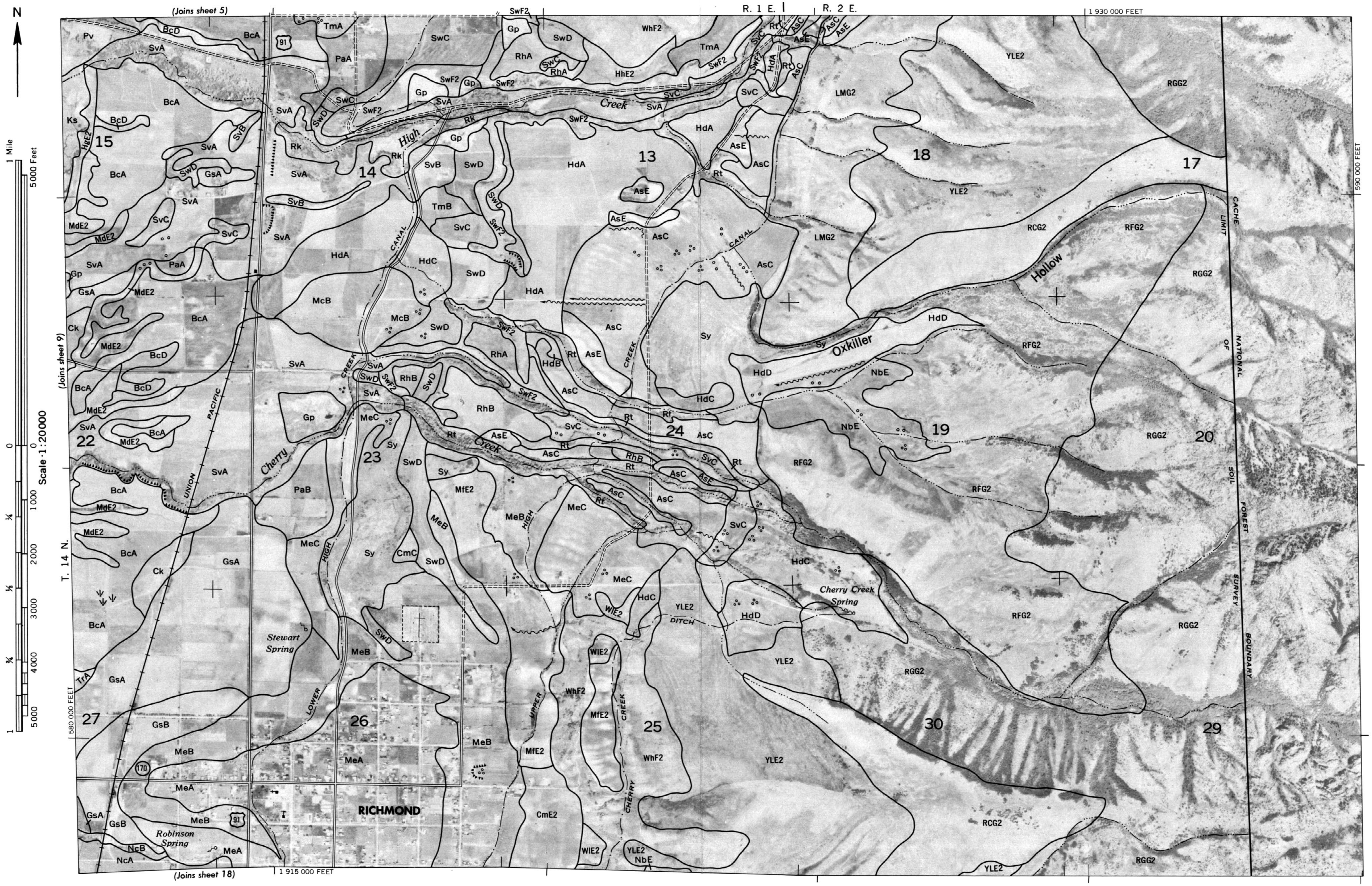
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 9

⑩

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 10



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 10

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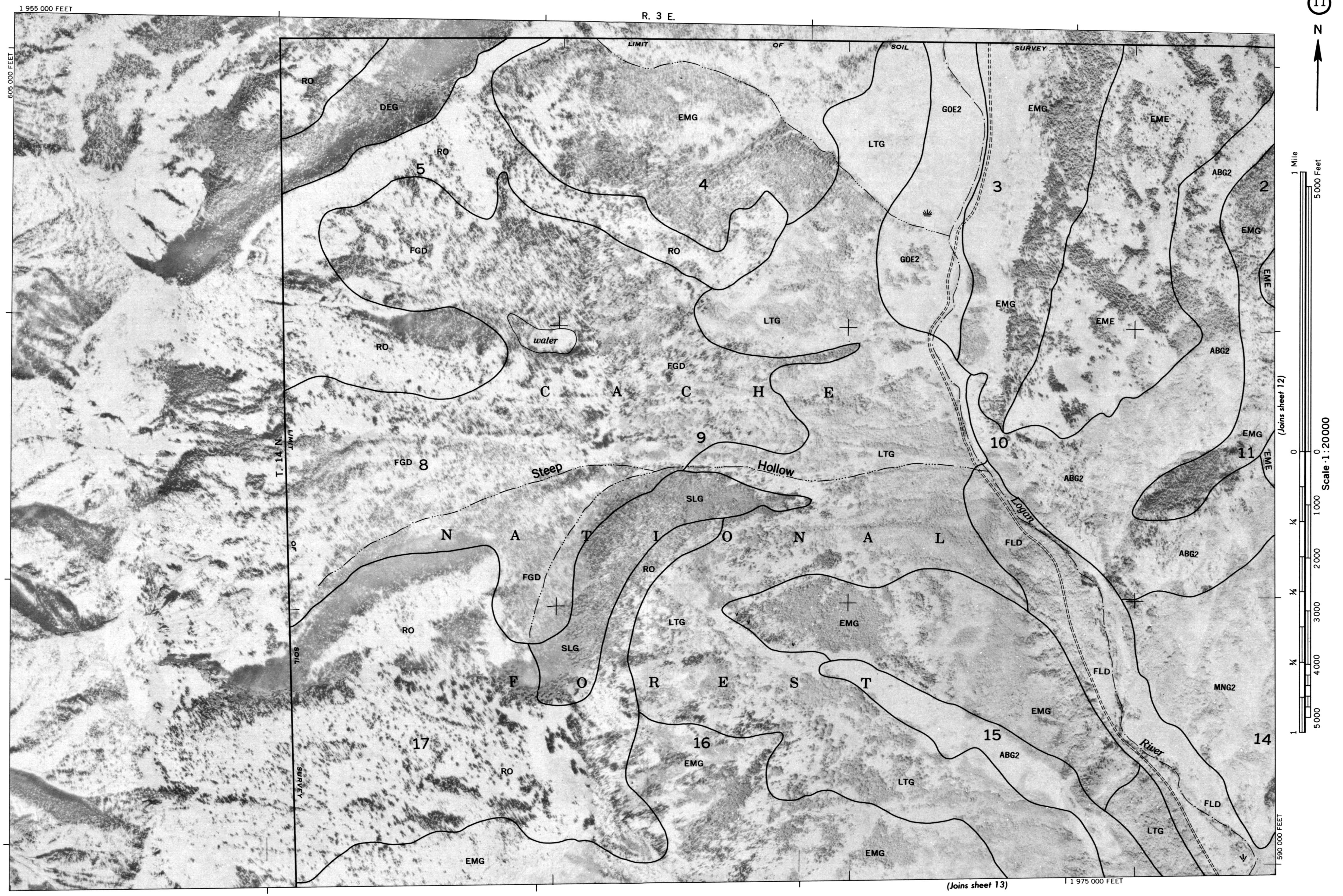
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 11



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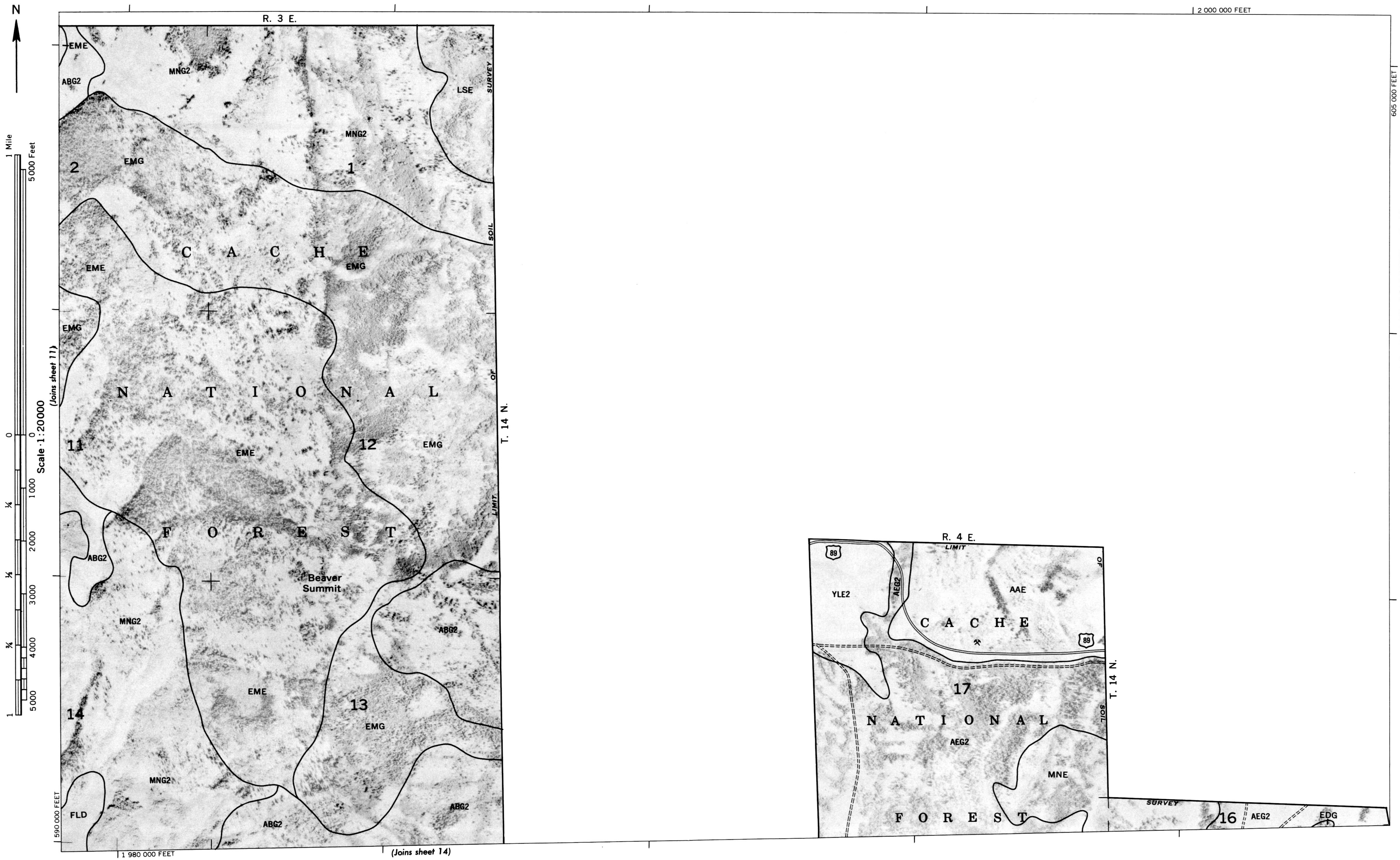
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 11

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 12



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 12

Land division corners are approximately positioned on this map.

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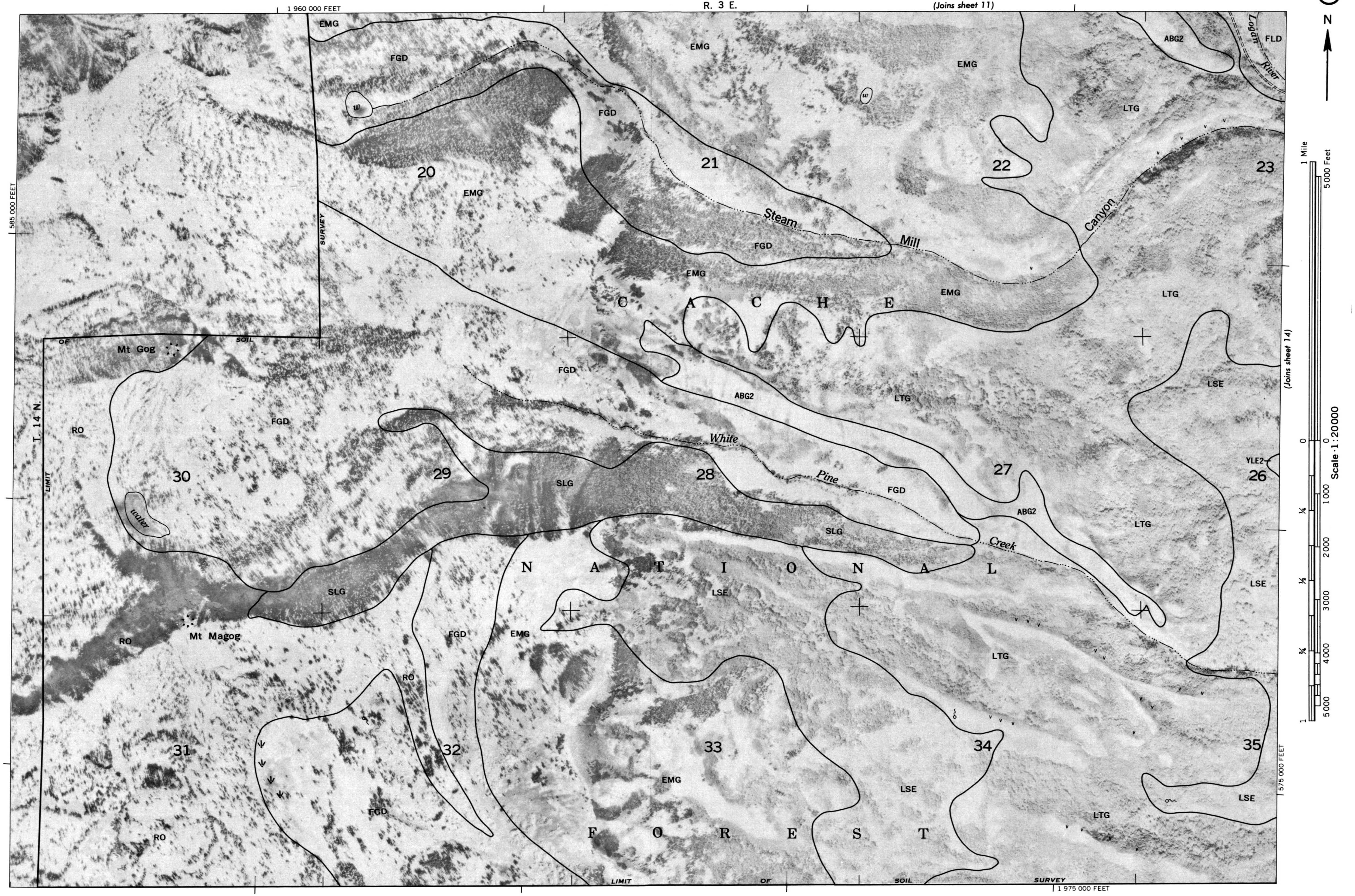
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 13

⑬



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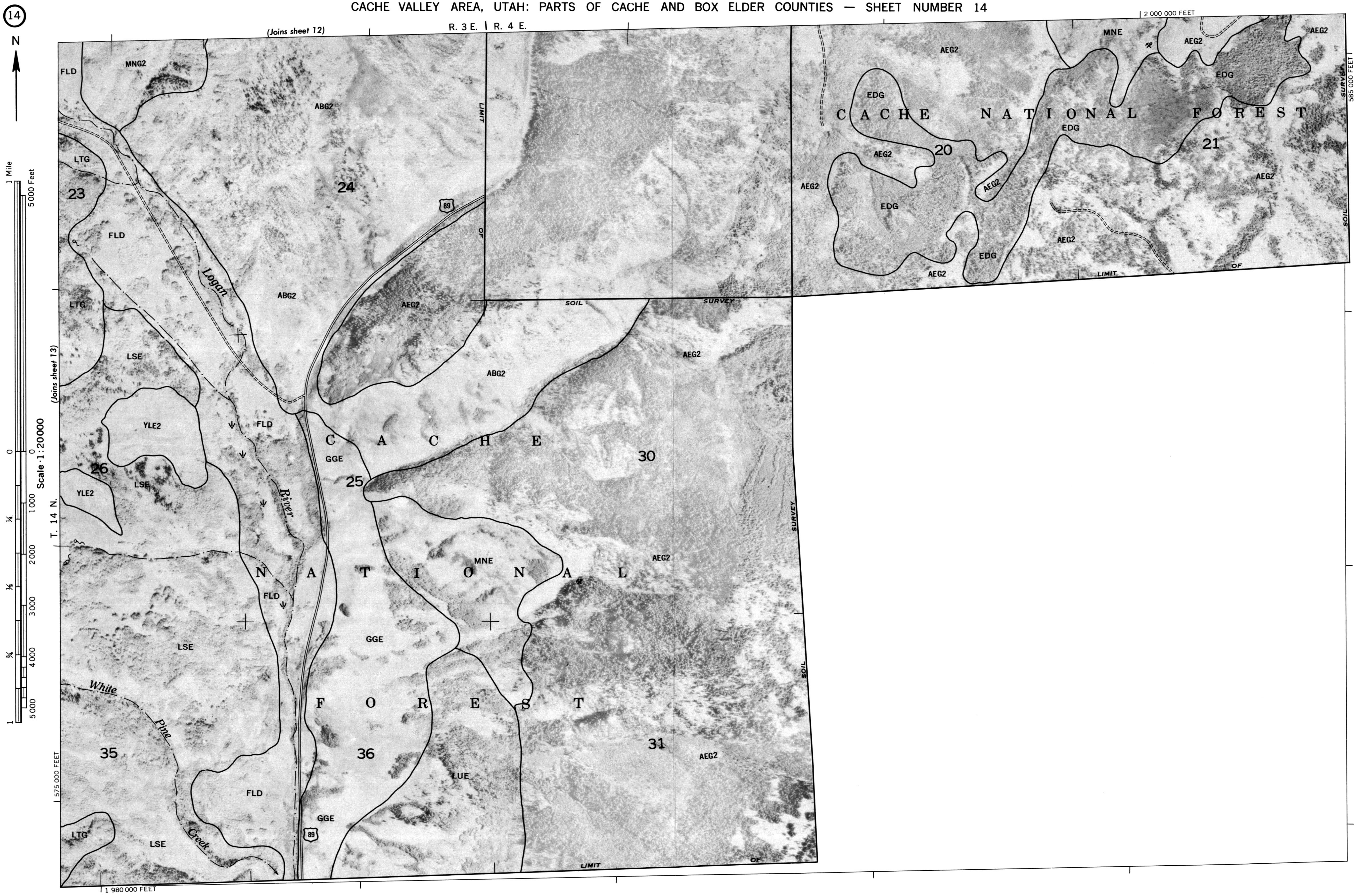
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 13

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 14



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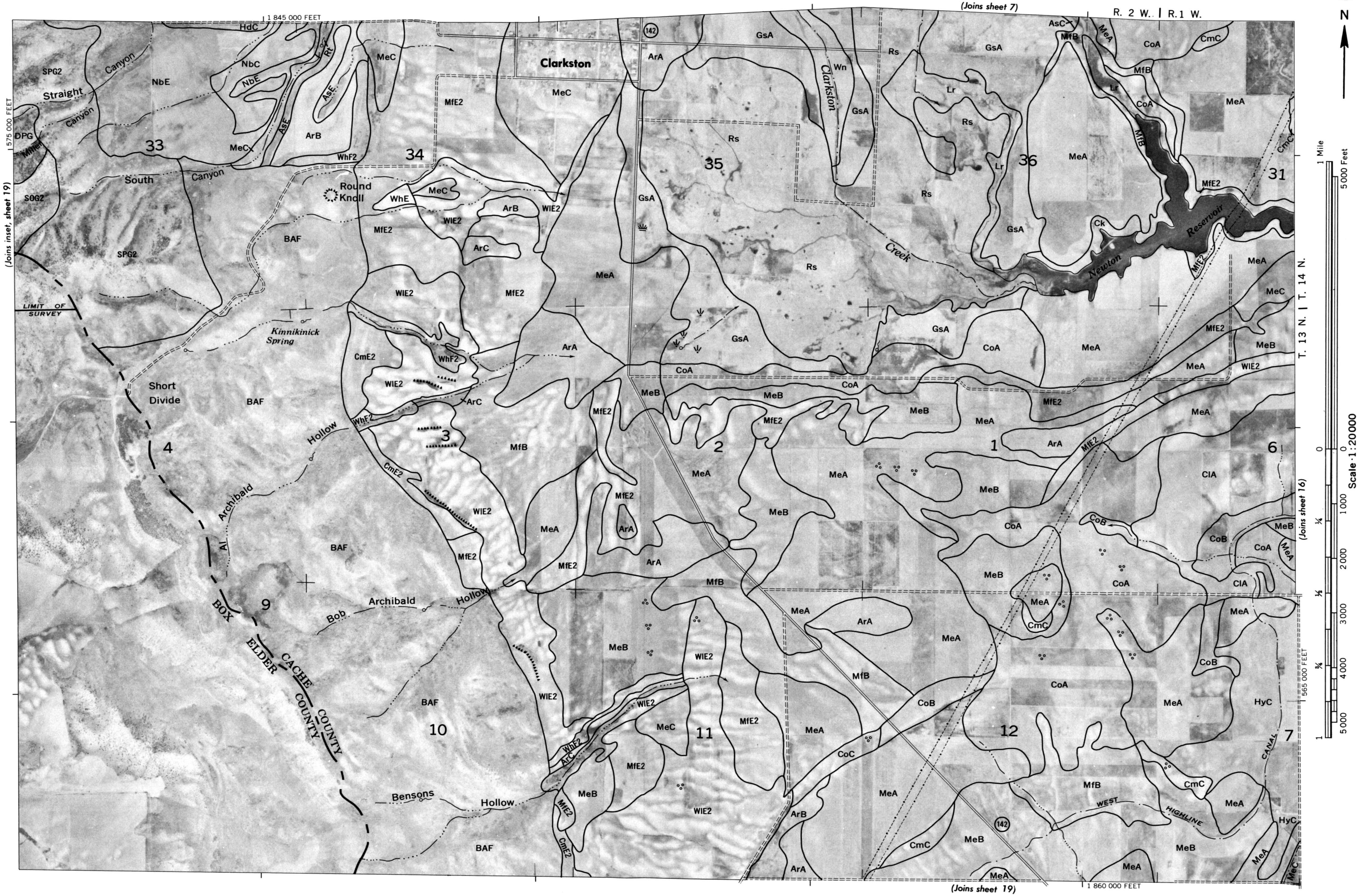
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 14

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 15

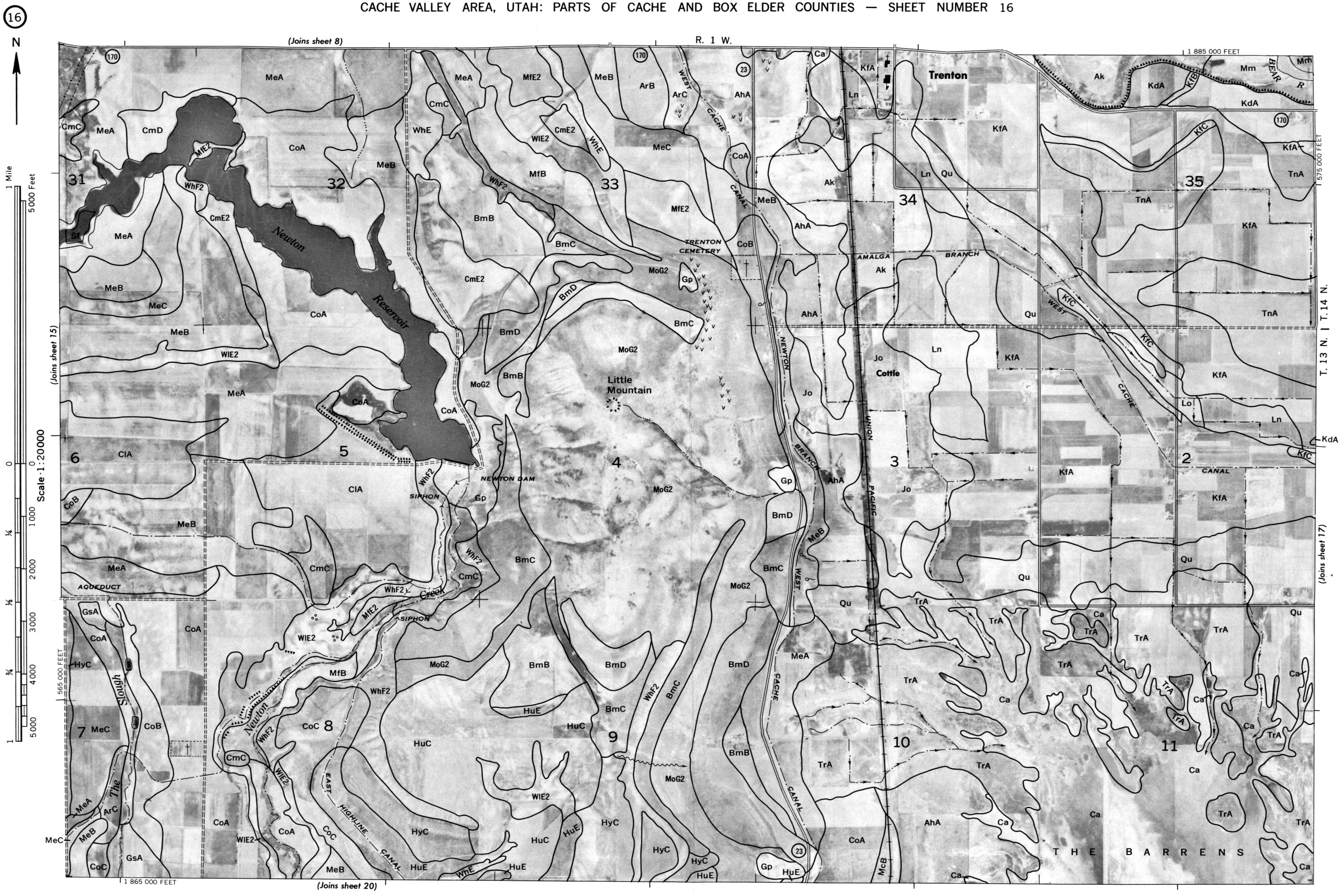
⑮



Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

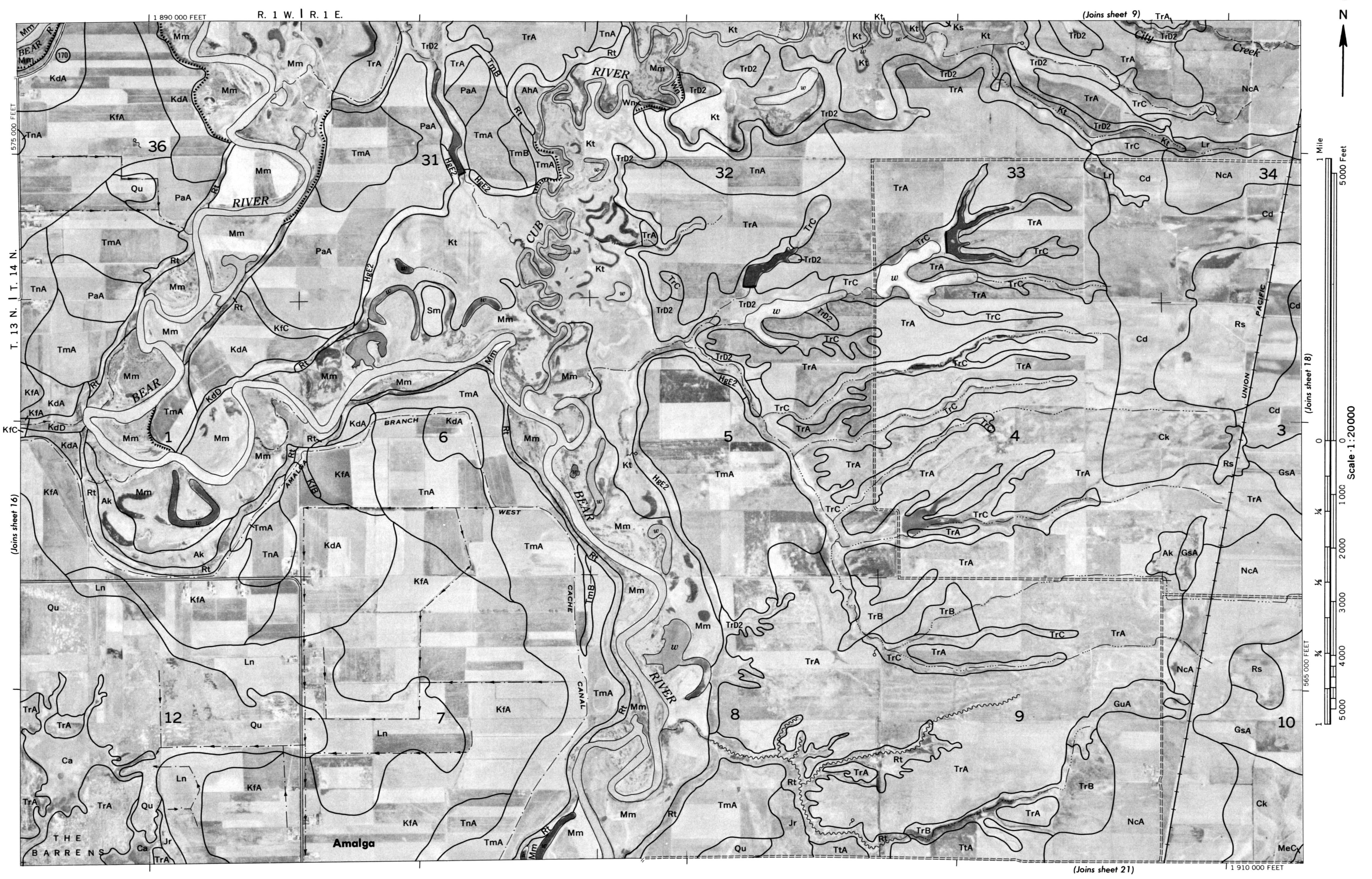
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 15

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 16



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 16
Land division corners are approximately positioned on this map.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

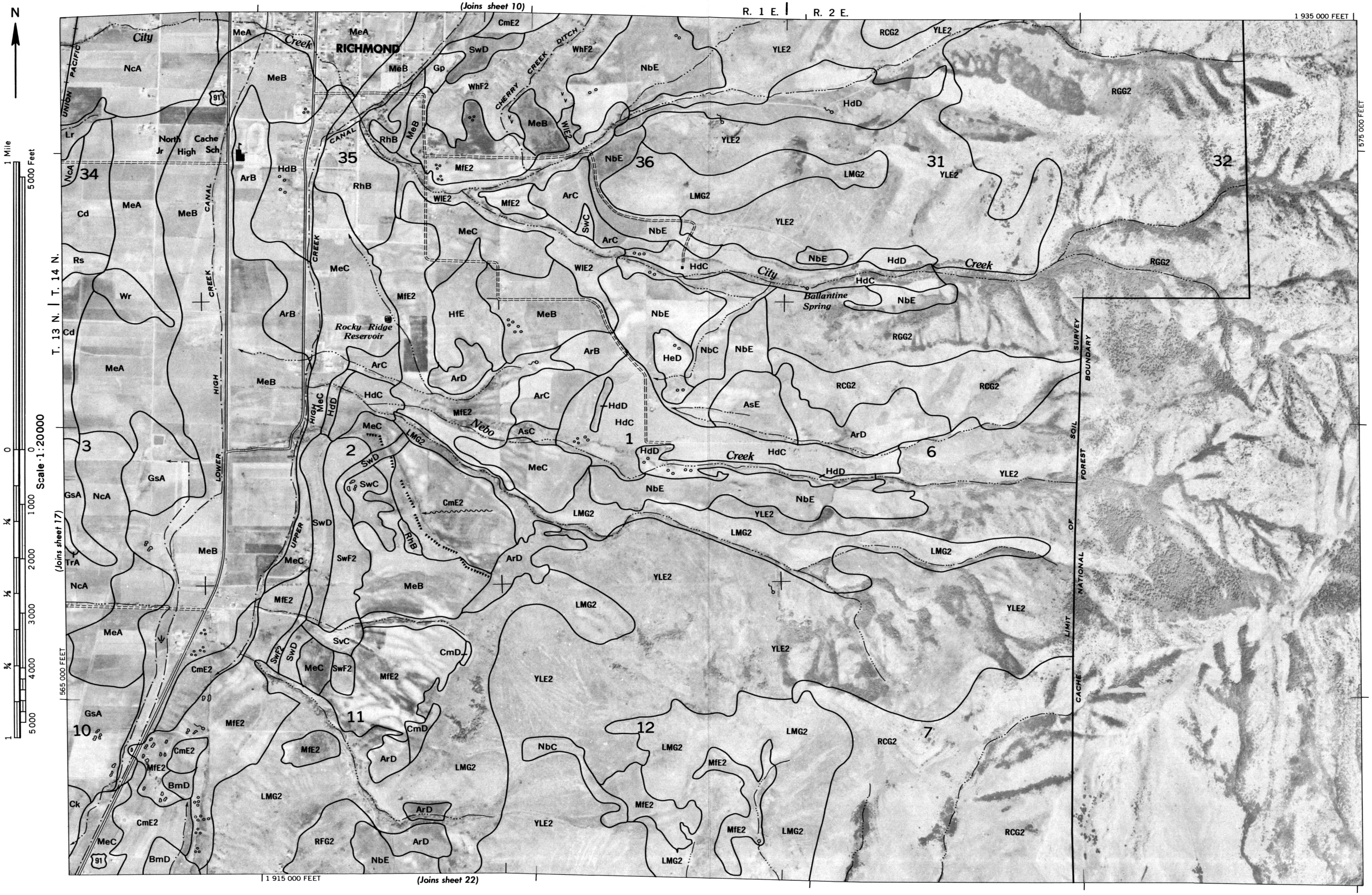
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 17



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 17

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 18



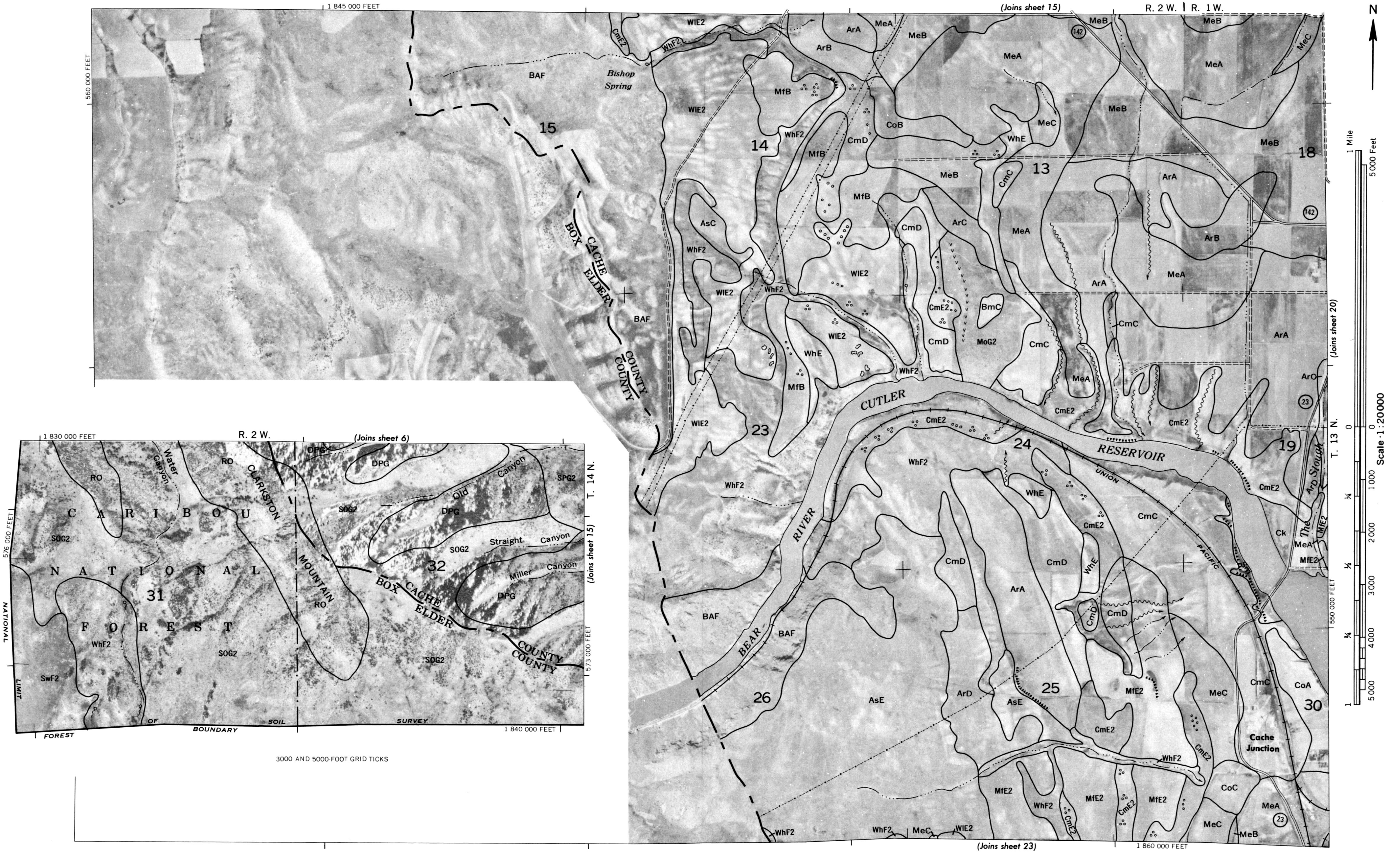
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 18

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 19



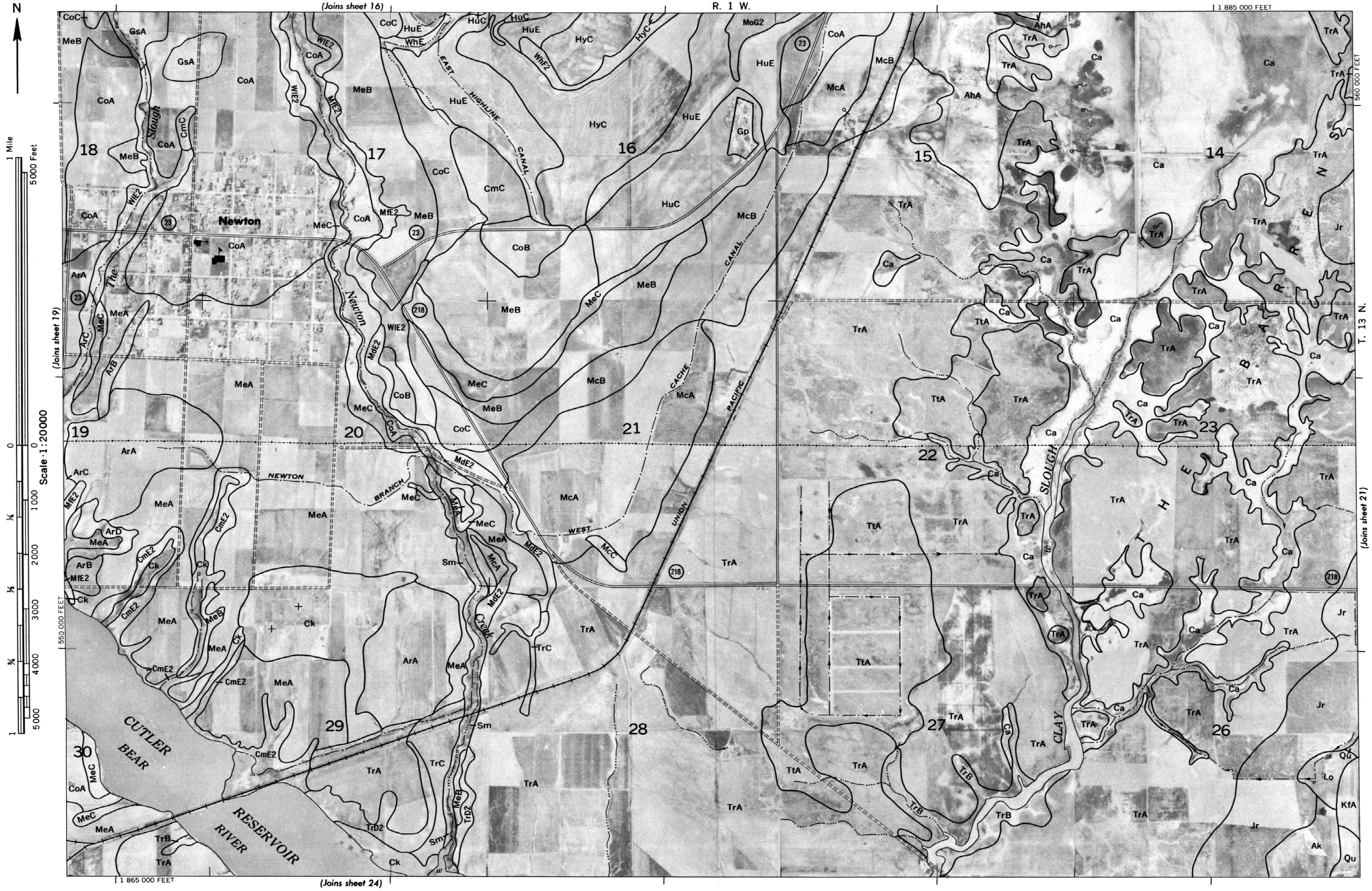
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 19

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone

Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 20



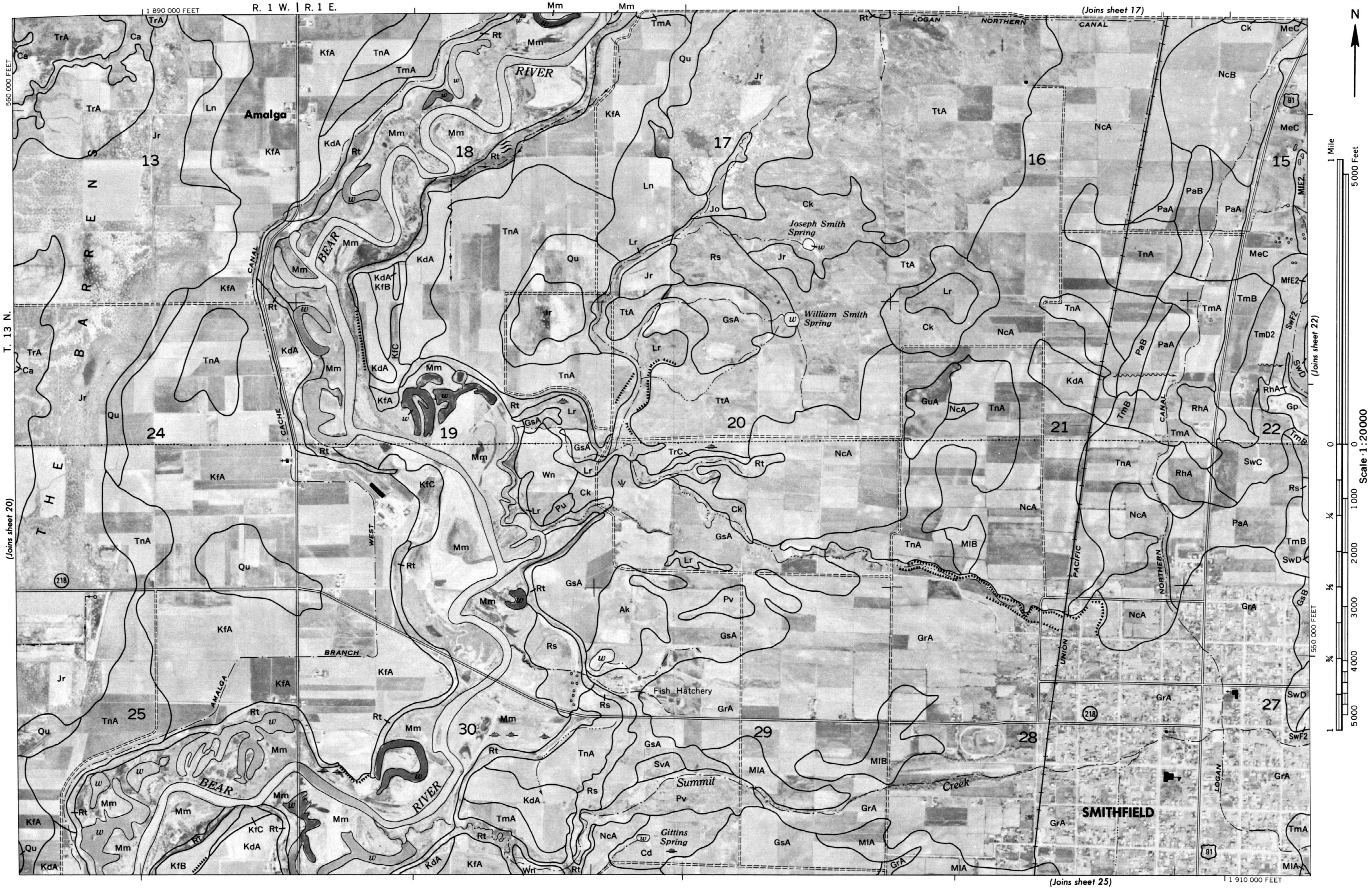
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 20

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 21



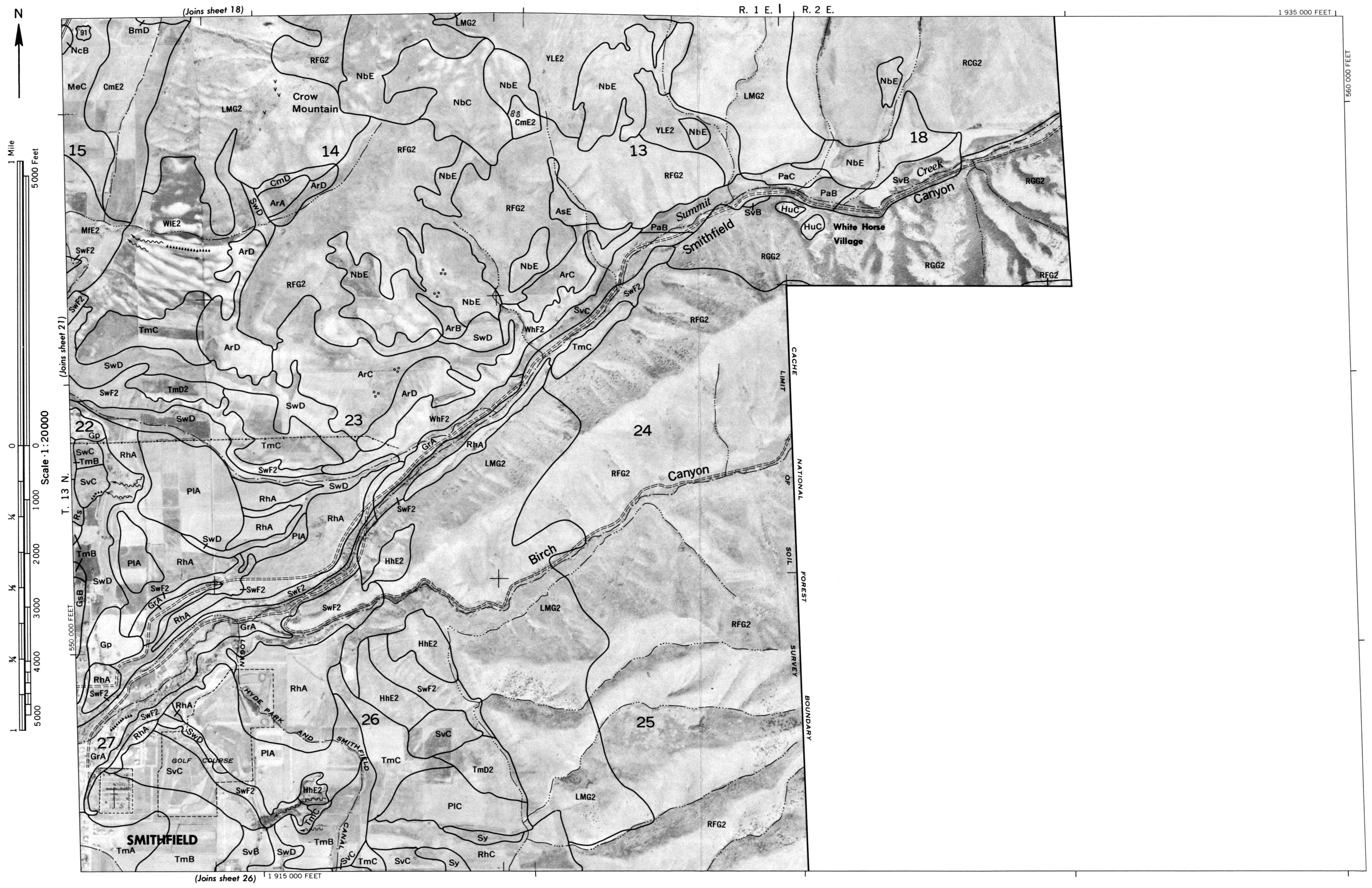
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 21

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 22



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 22

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 23

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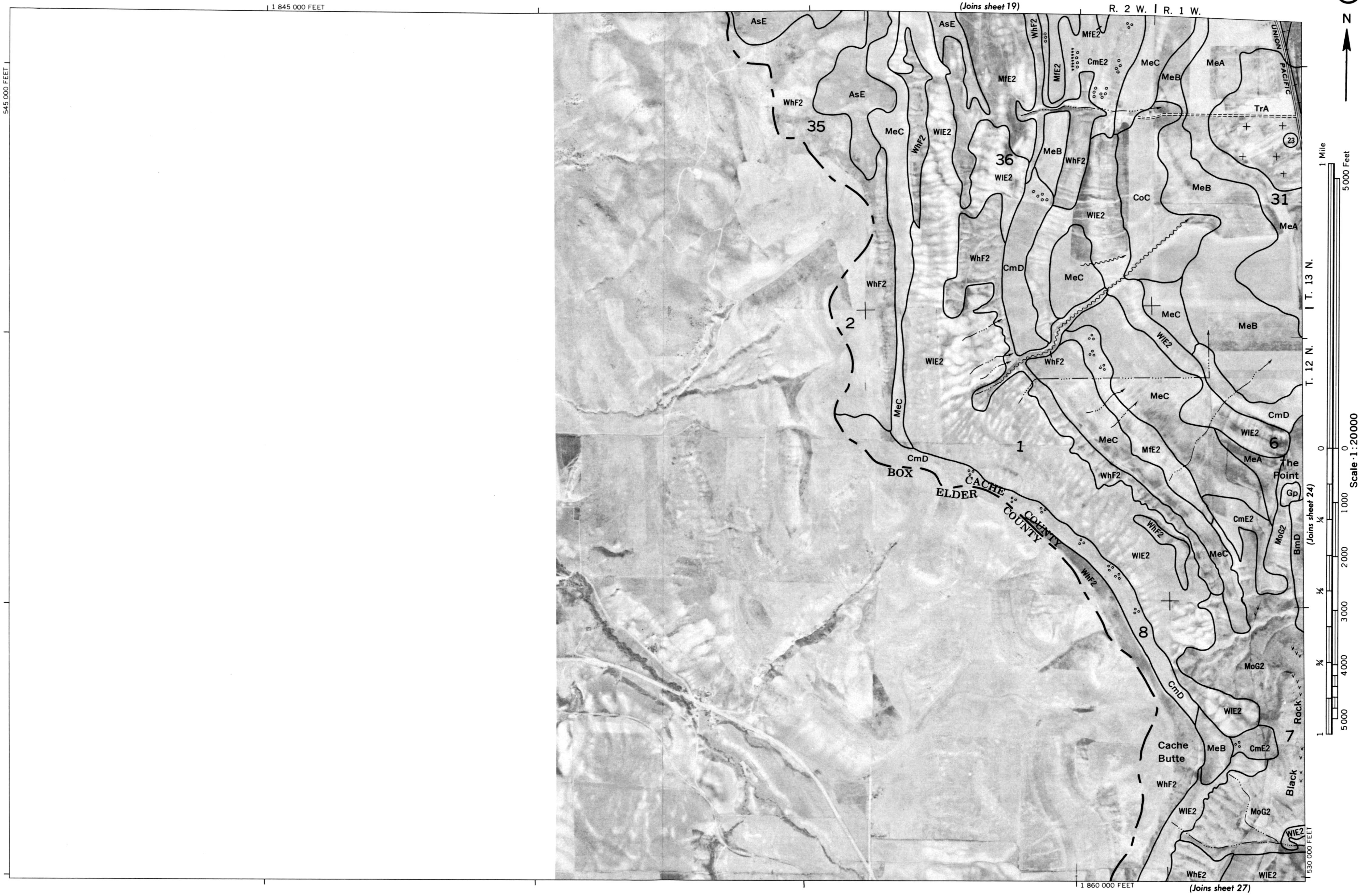
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

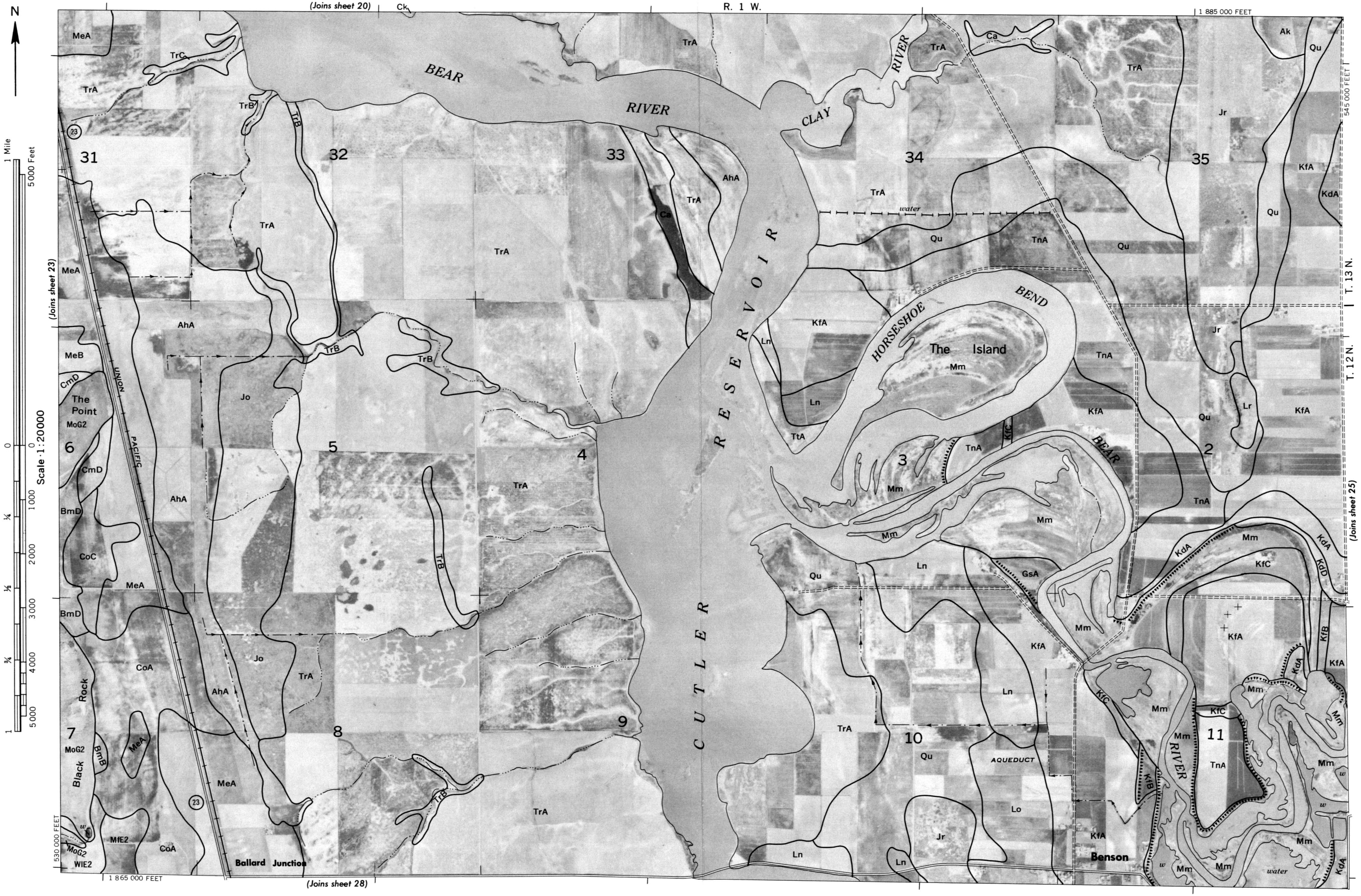
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 23



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 24



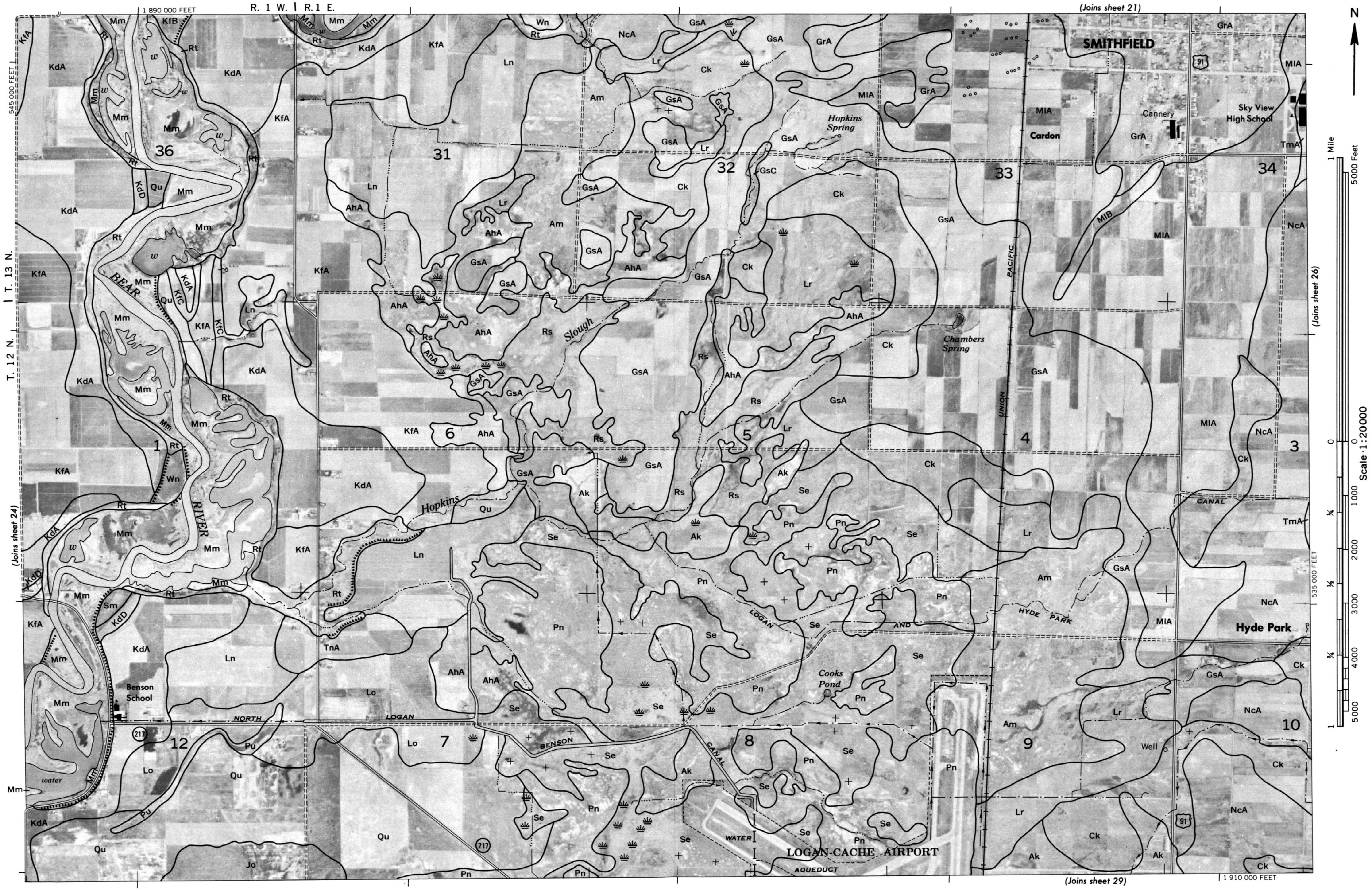
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 24

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 25



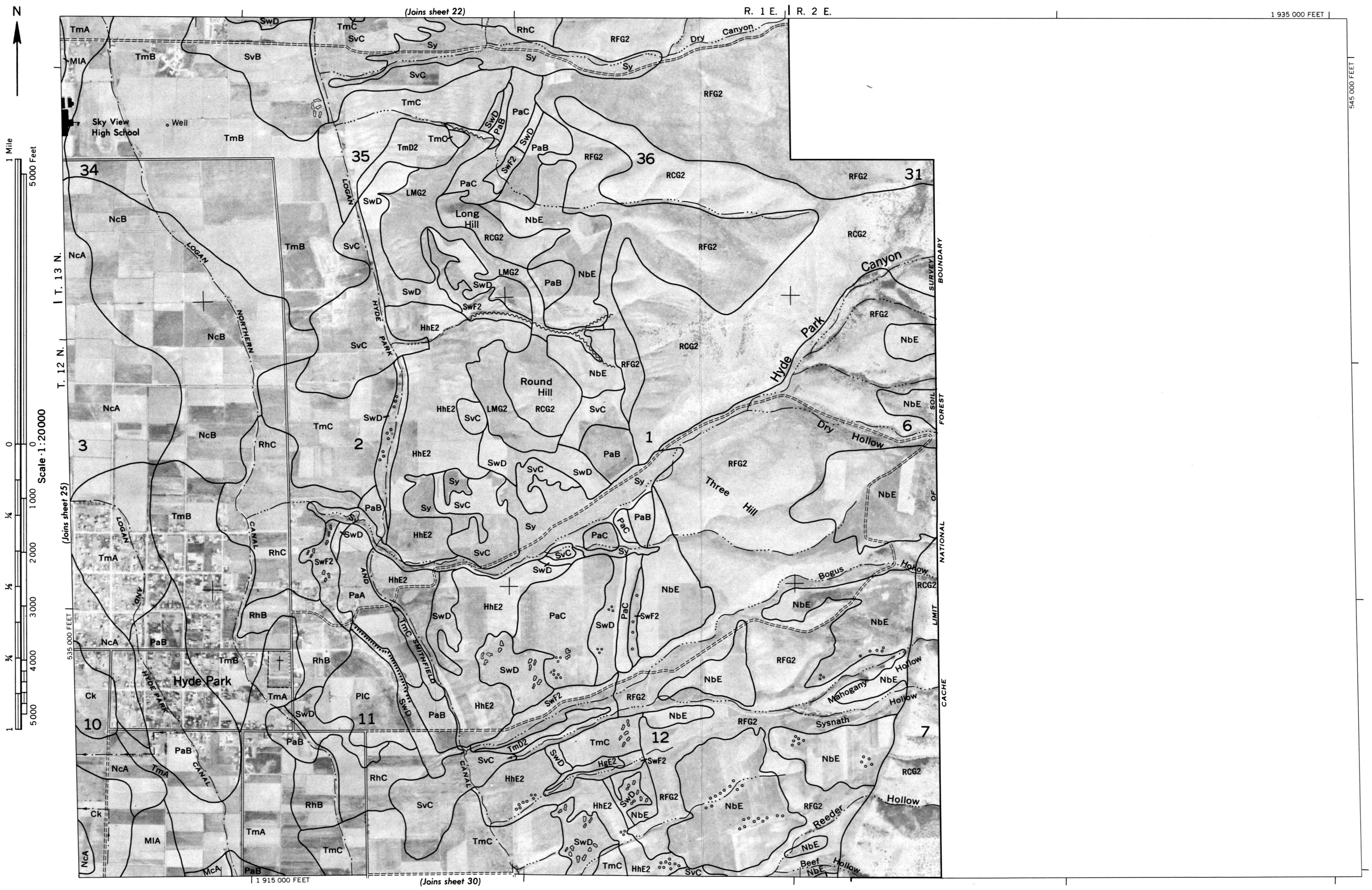
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

Land division corners are approximately positioned on this map.

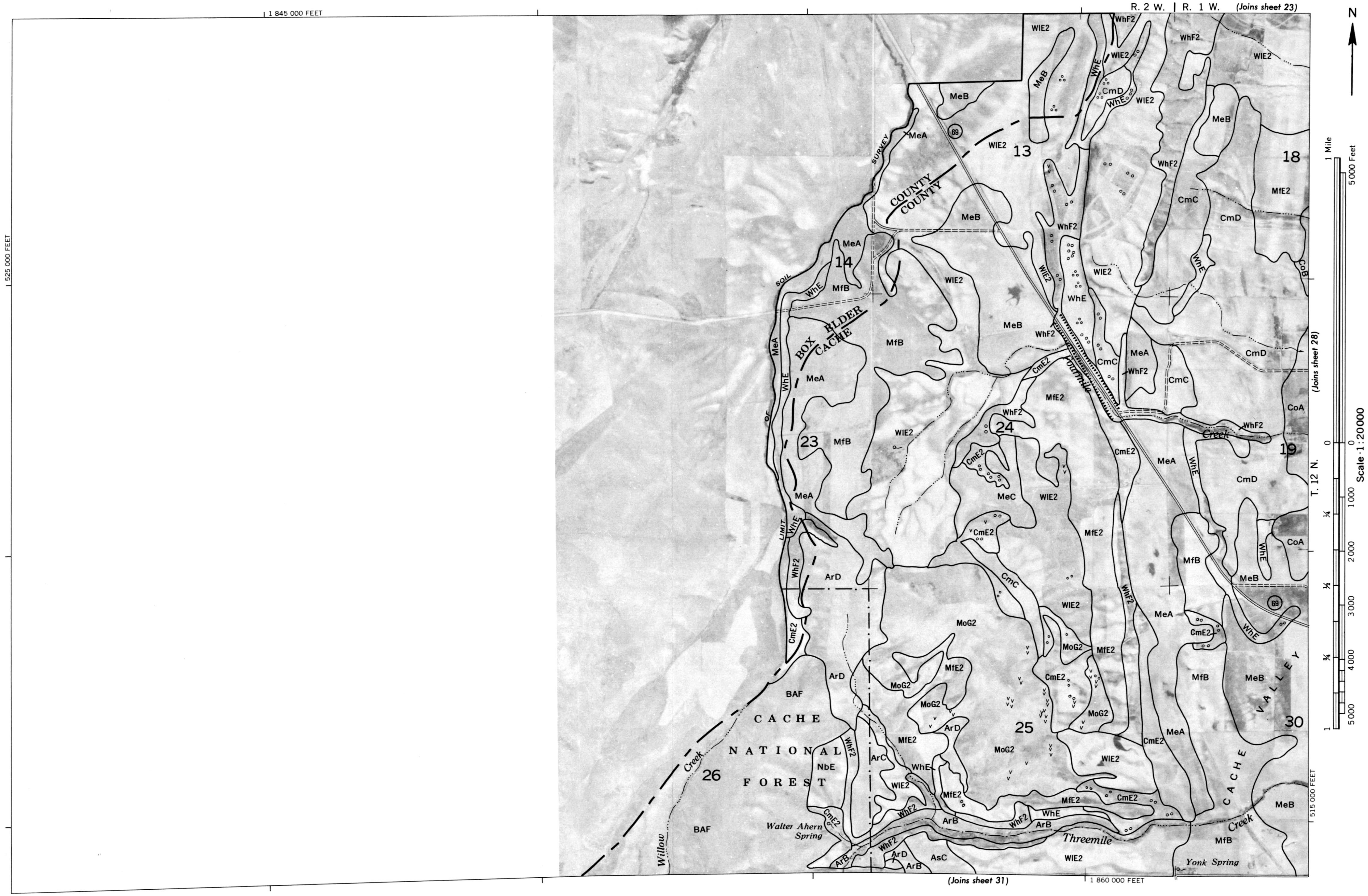
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 25

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 26



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 26
Land division corners are approximately positioned on this map.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

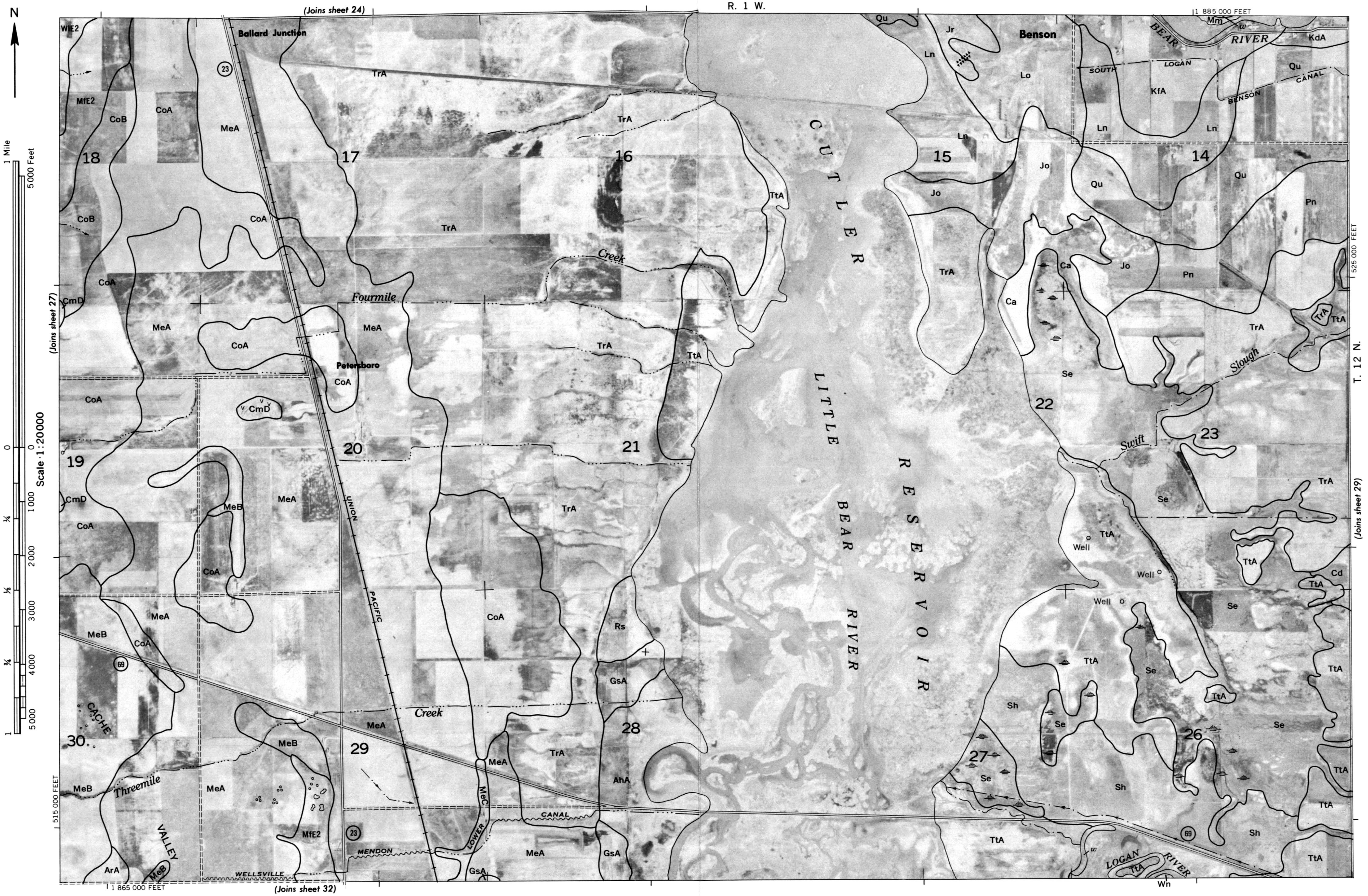
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 27



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 27

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 28



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTUES NO. 28

Land division corners are approximately positioned on this map.

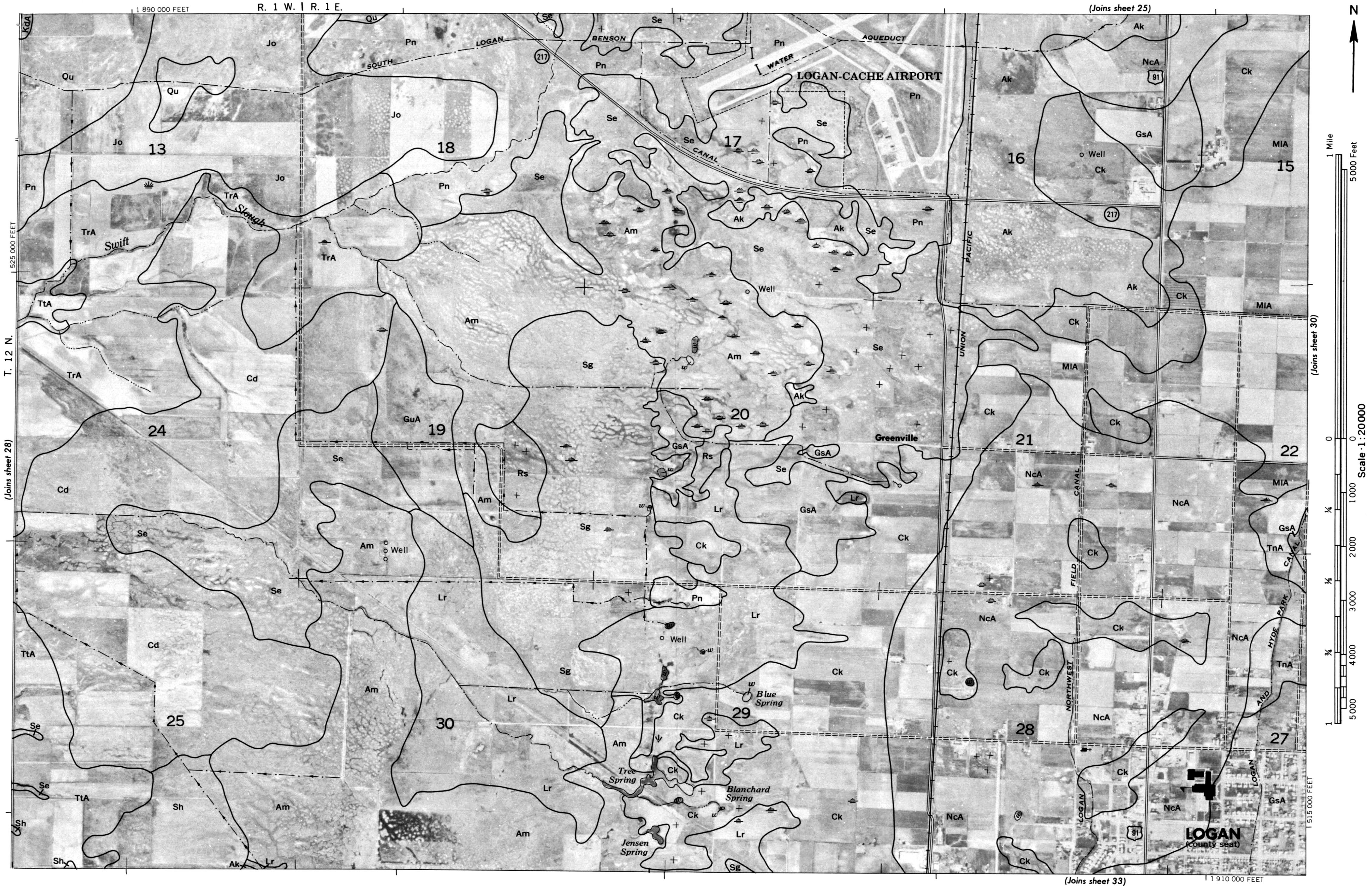
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

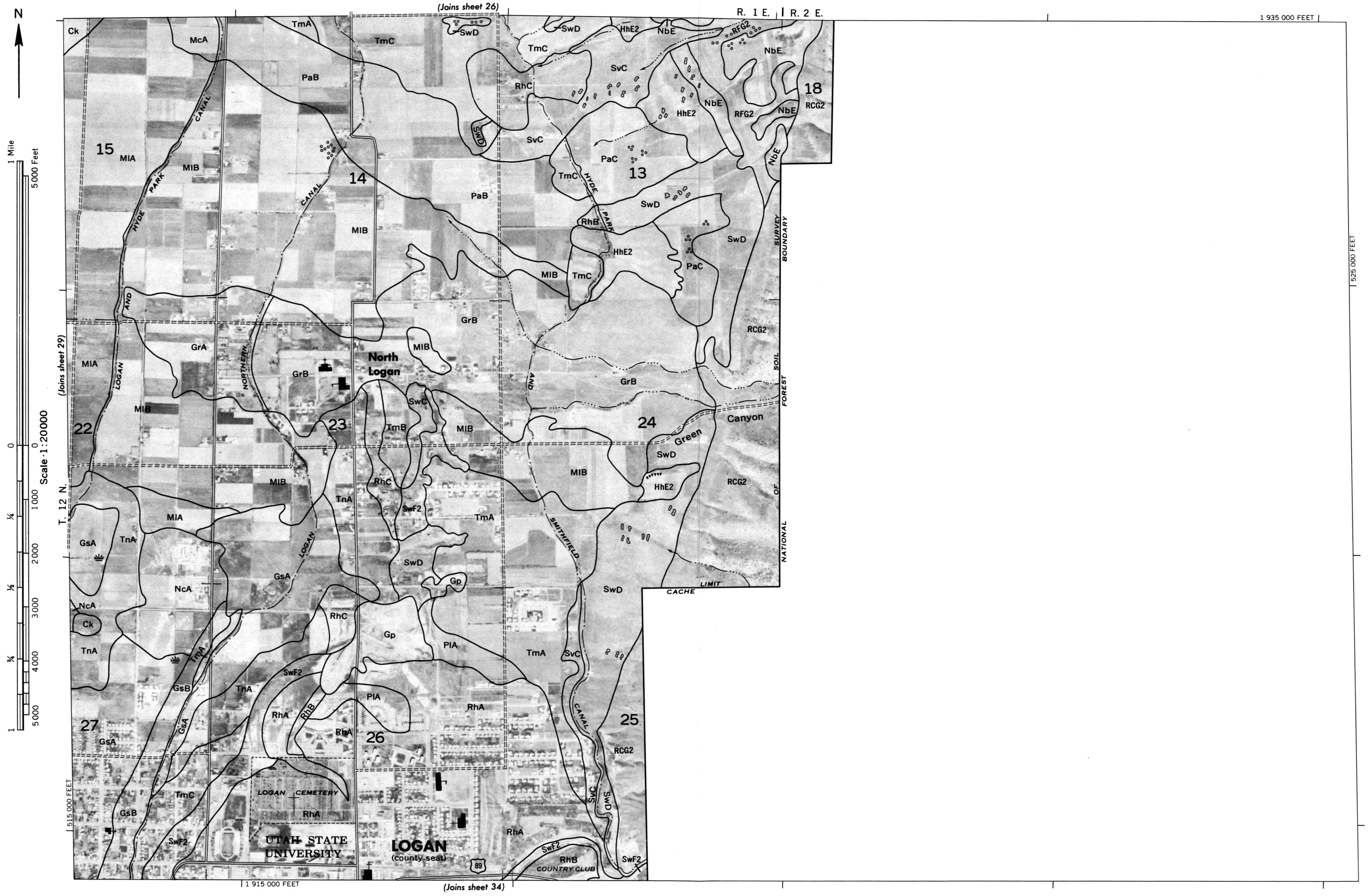
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 29

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 29



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 30



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 30

Land division corners are approximately positioned on this map.

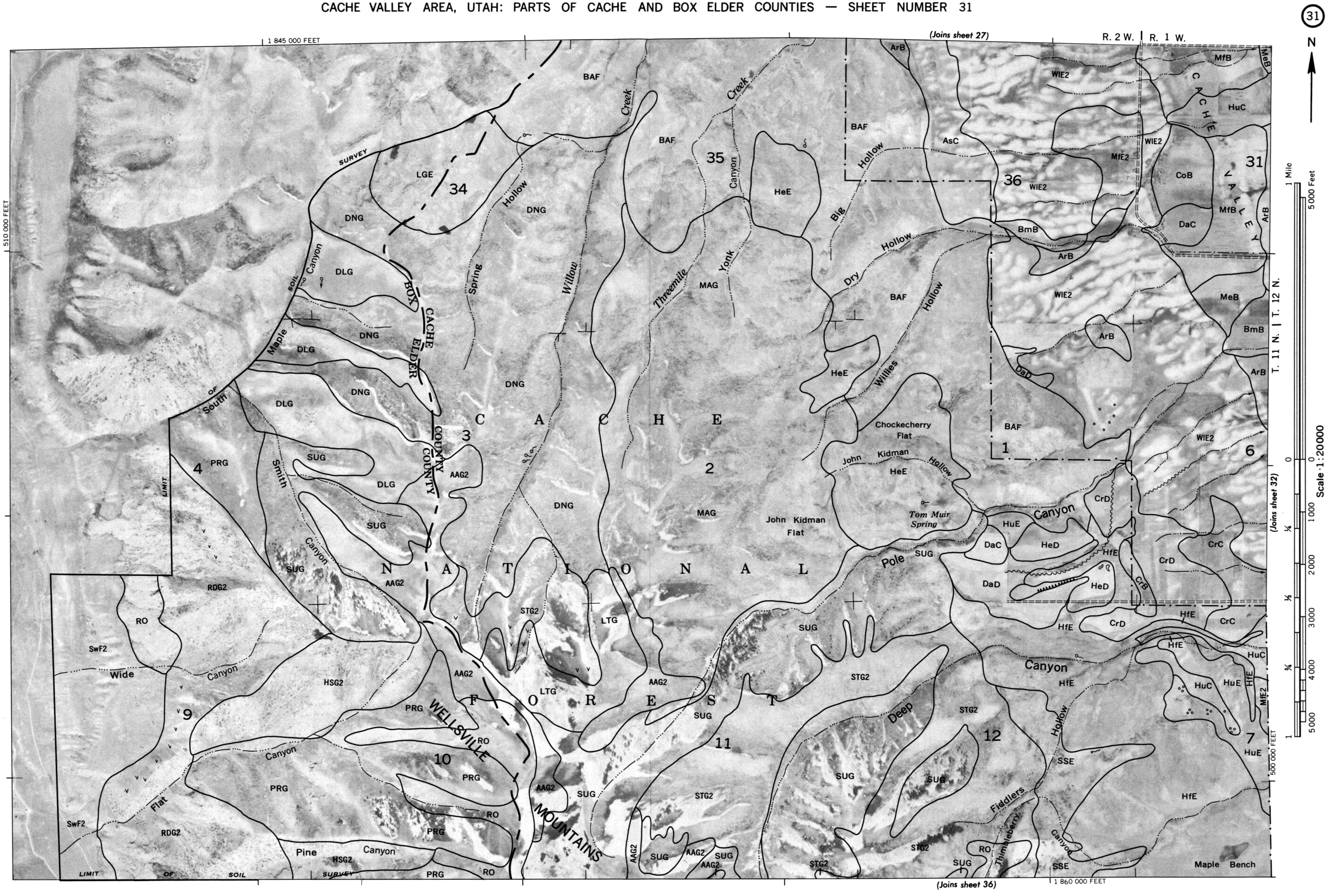
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

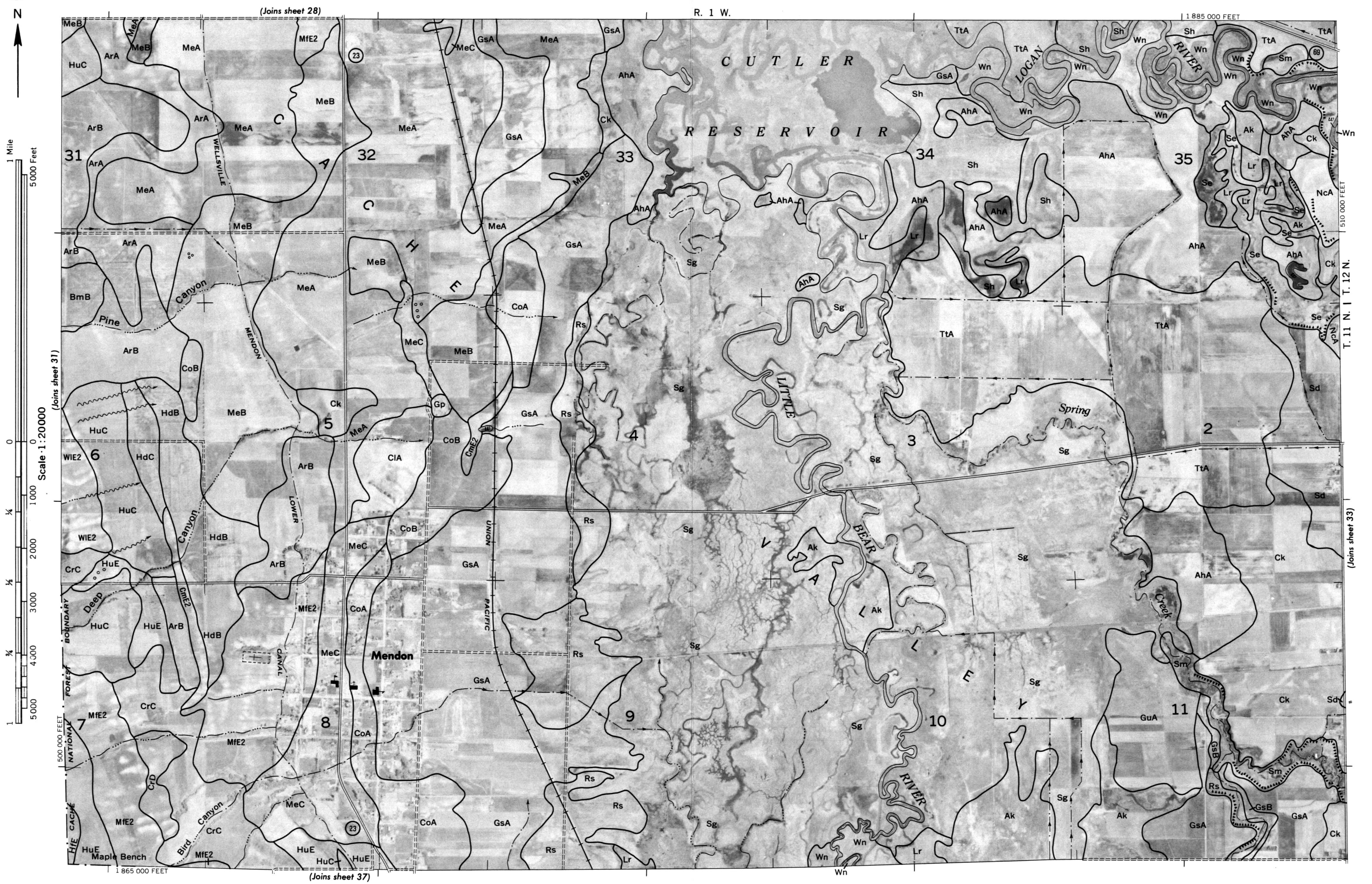
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 31

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 31



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 32



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 32

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

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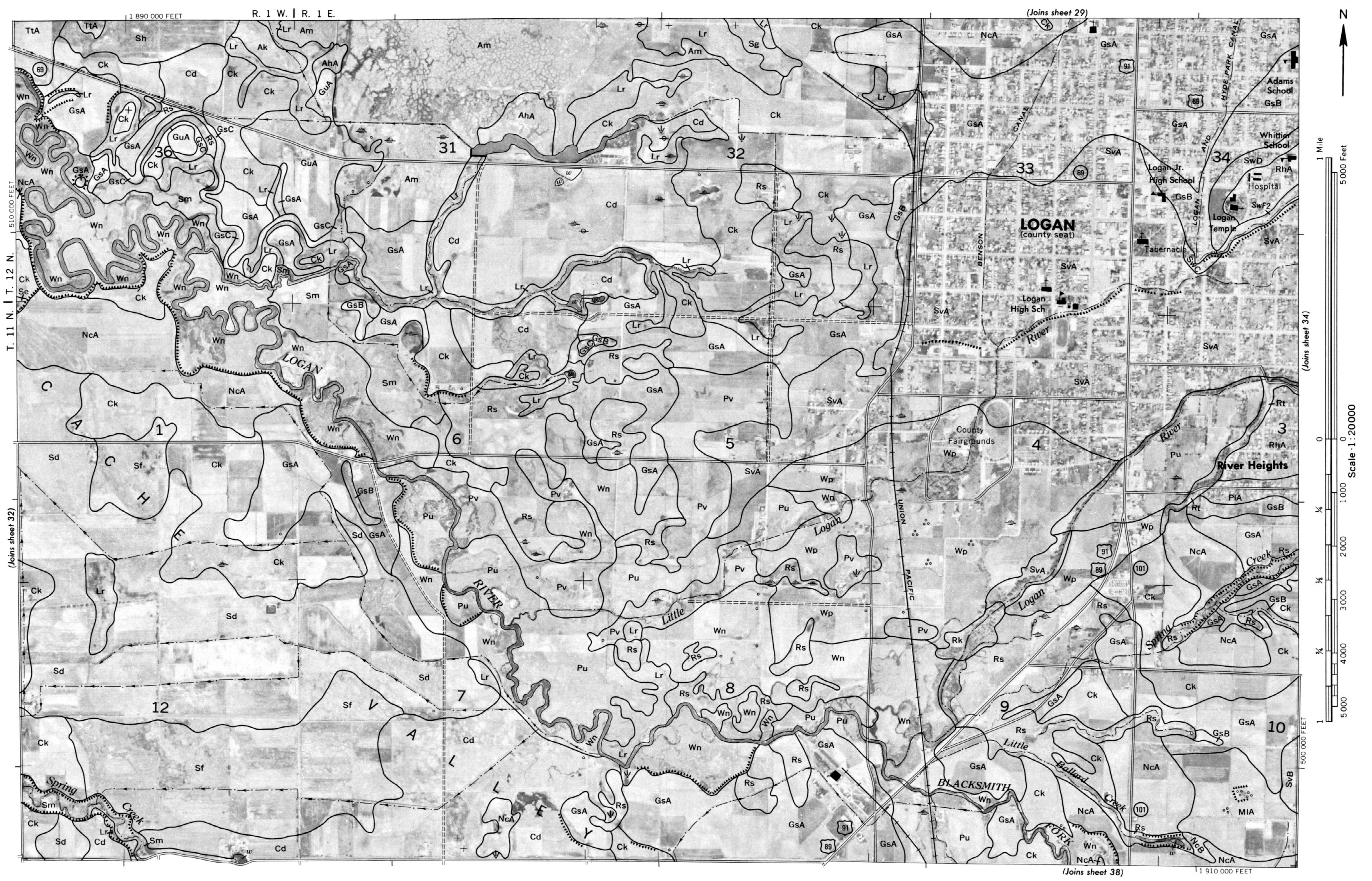
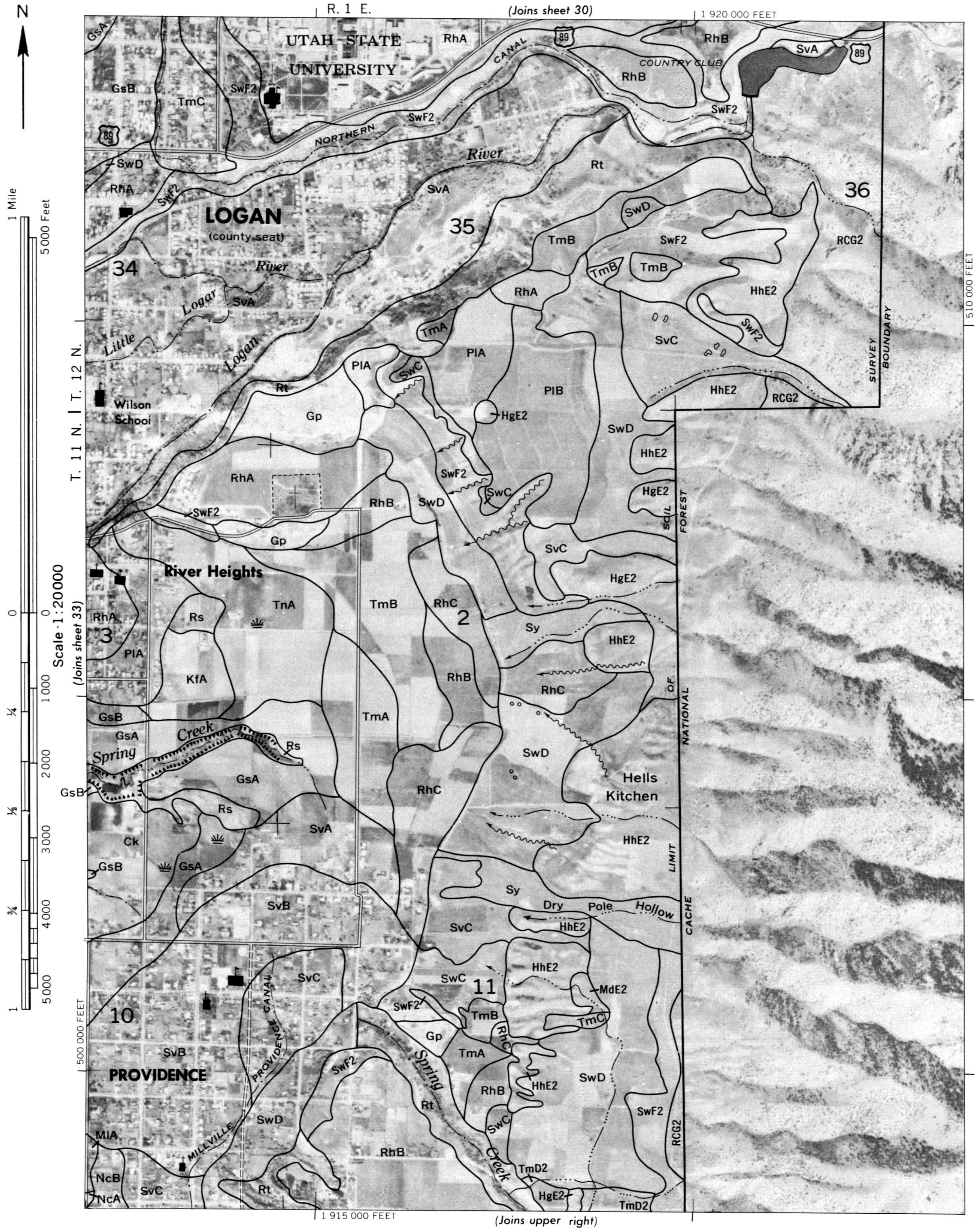
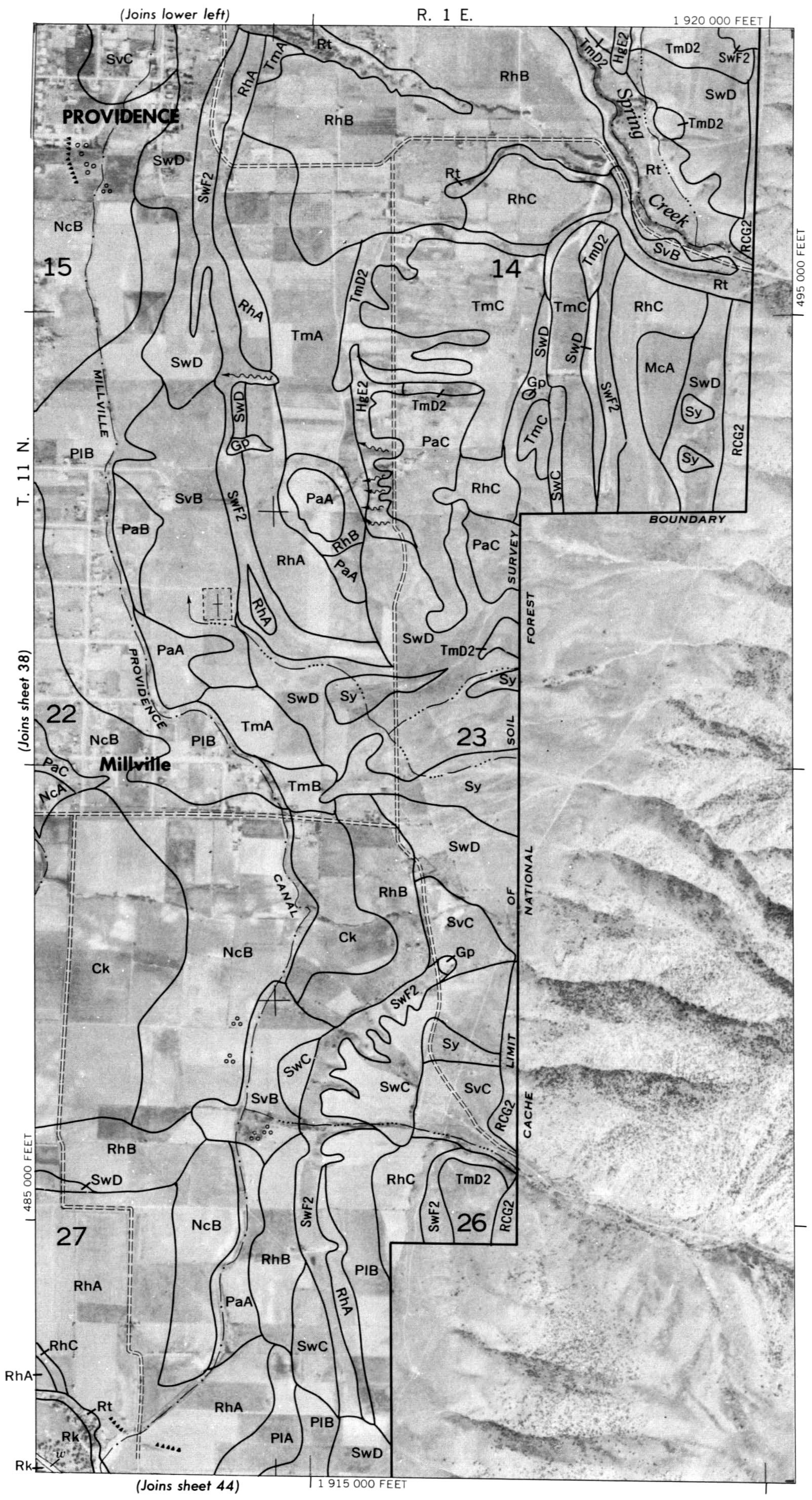
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 33



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 34





CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 34

Land division corners are approximately positioned on this map.

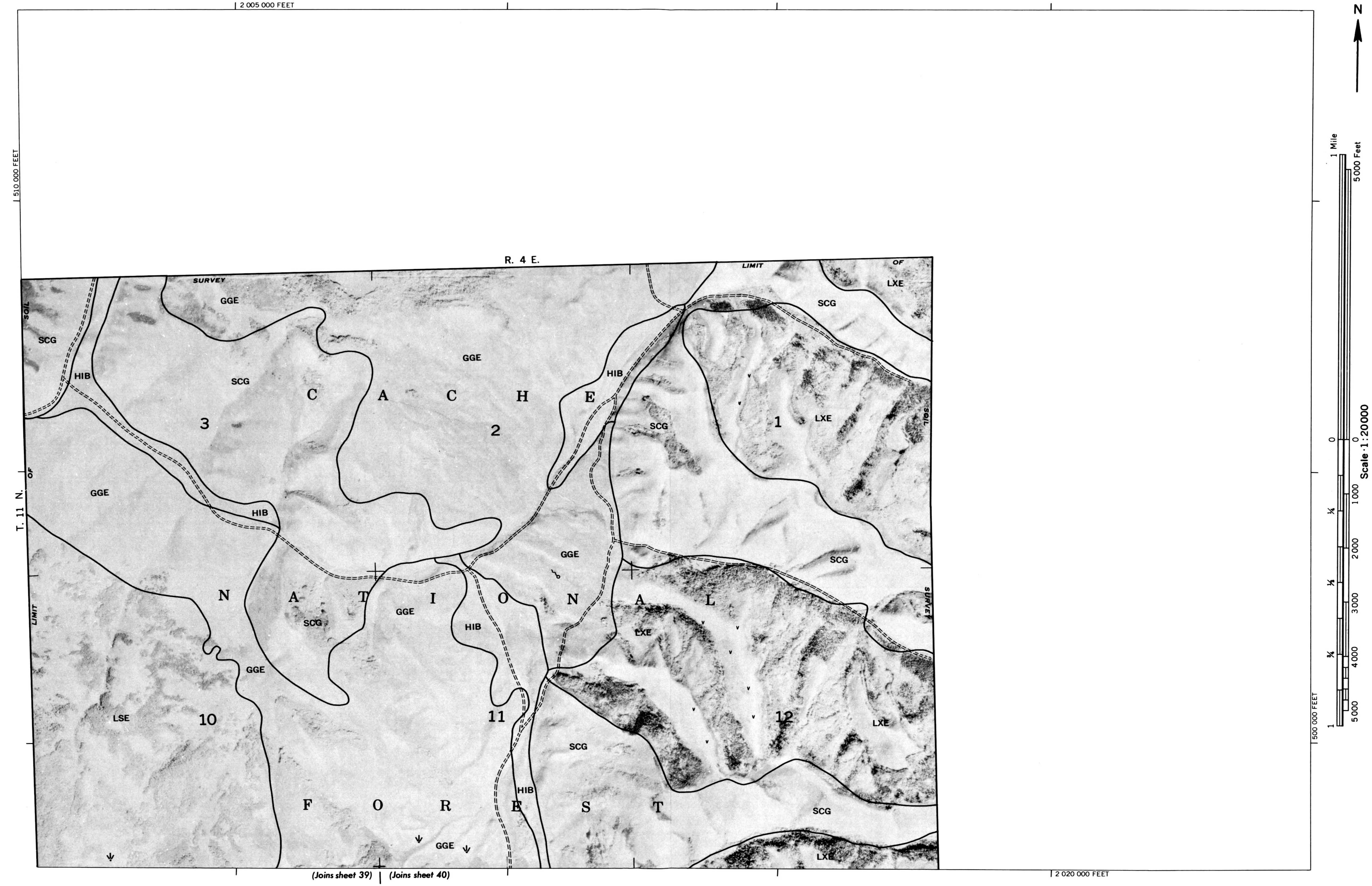
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 35

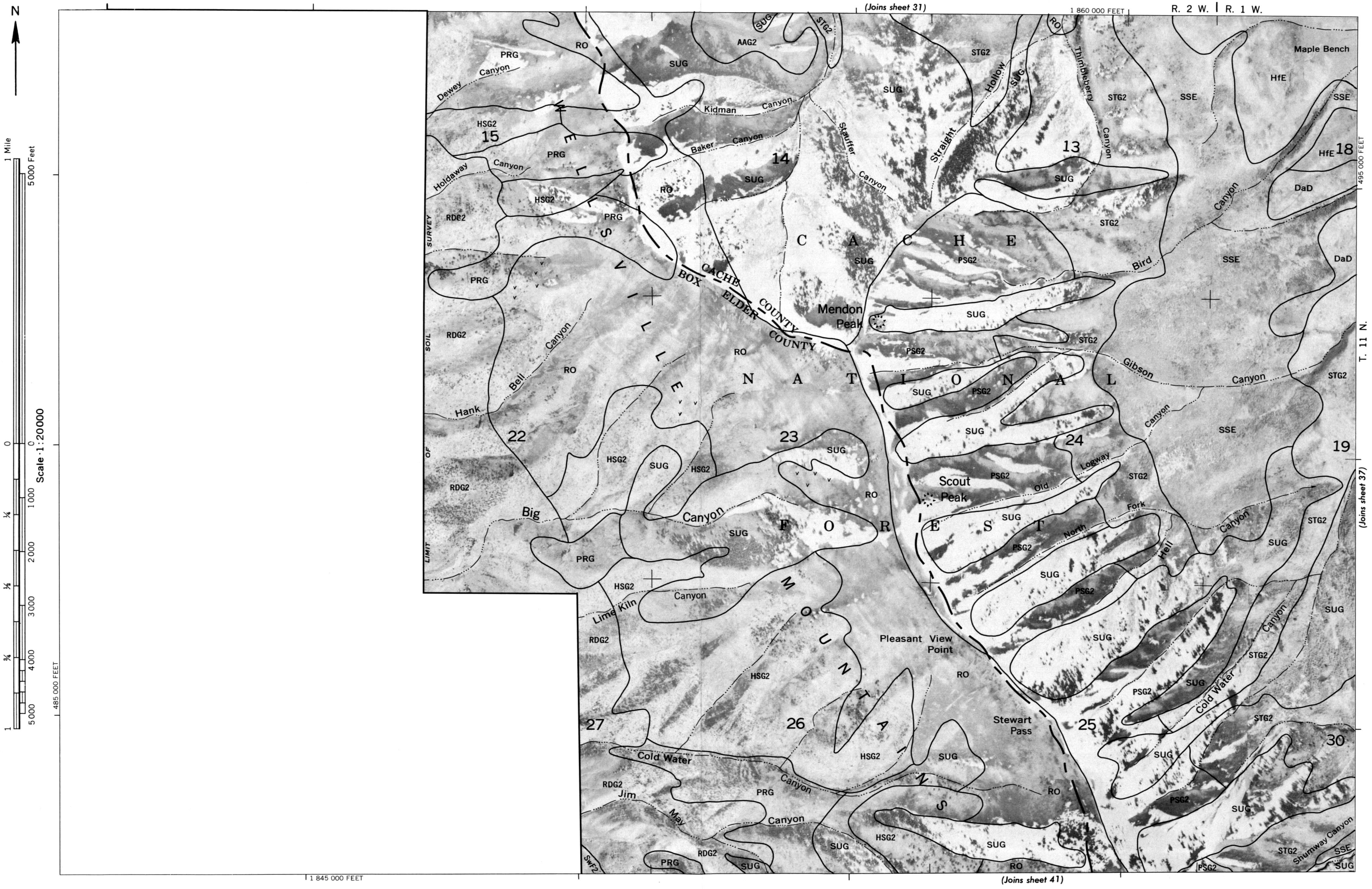
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 35



(Joins sheet 39) | (Joins sheet 40)

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 36



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 36

Land division corners are approximately positioned on this map.

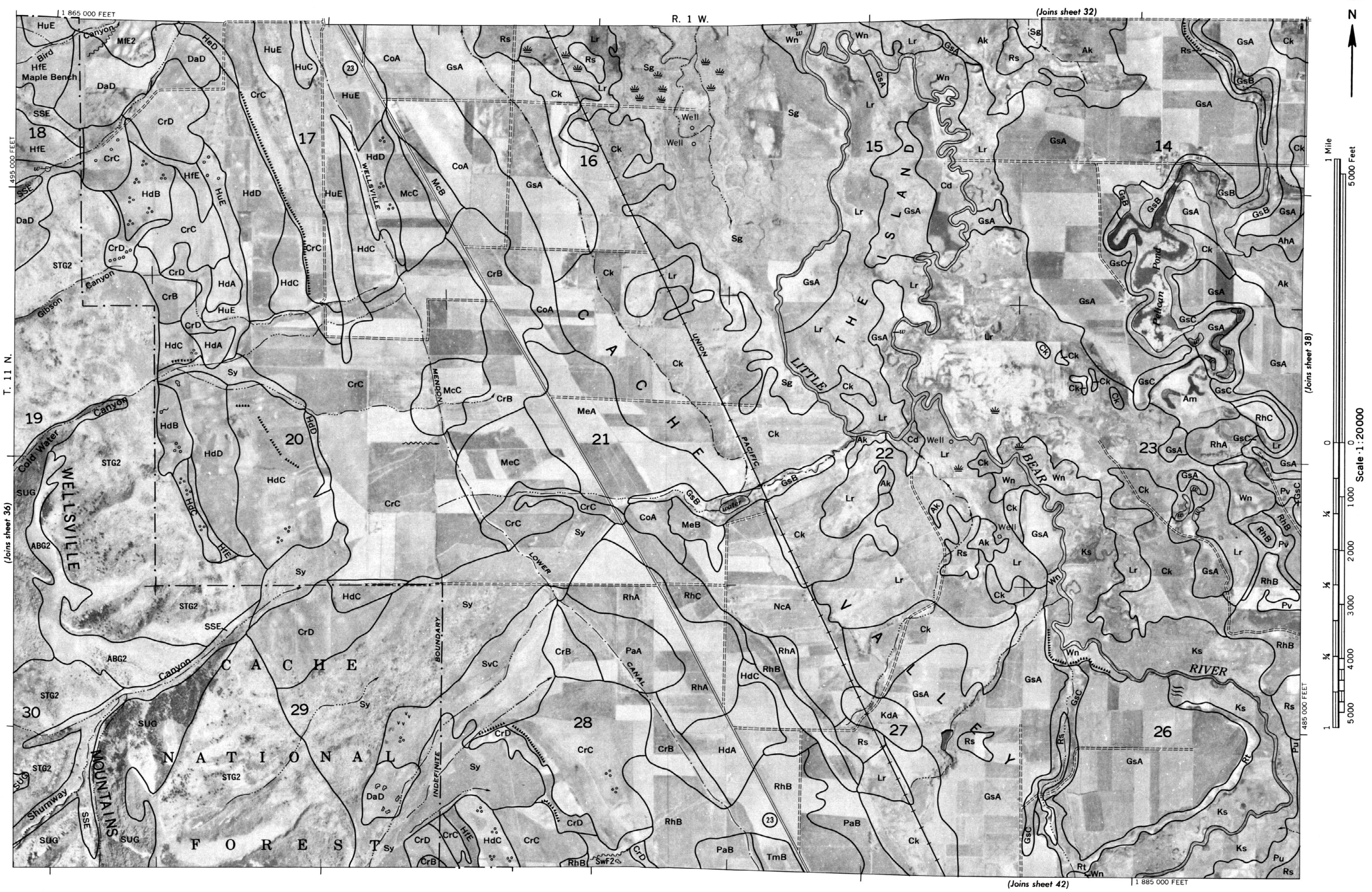
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 37

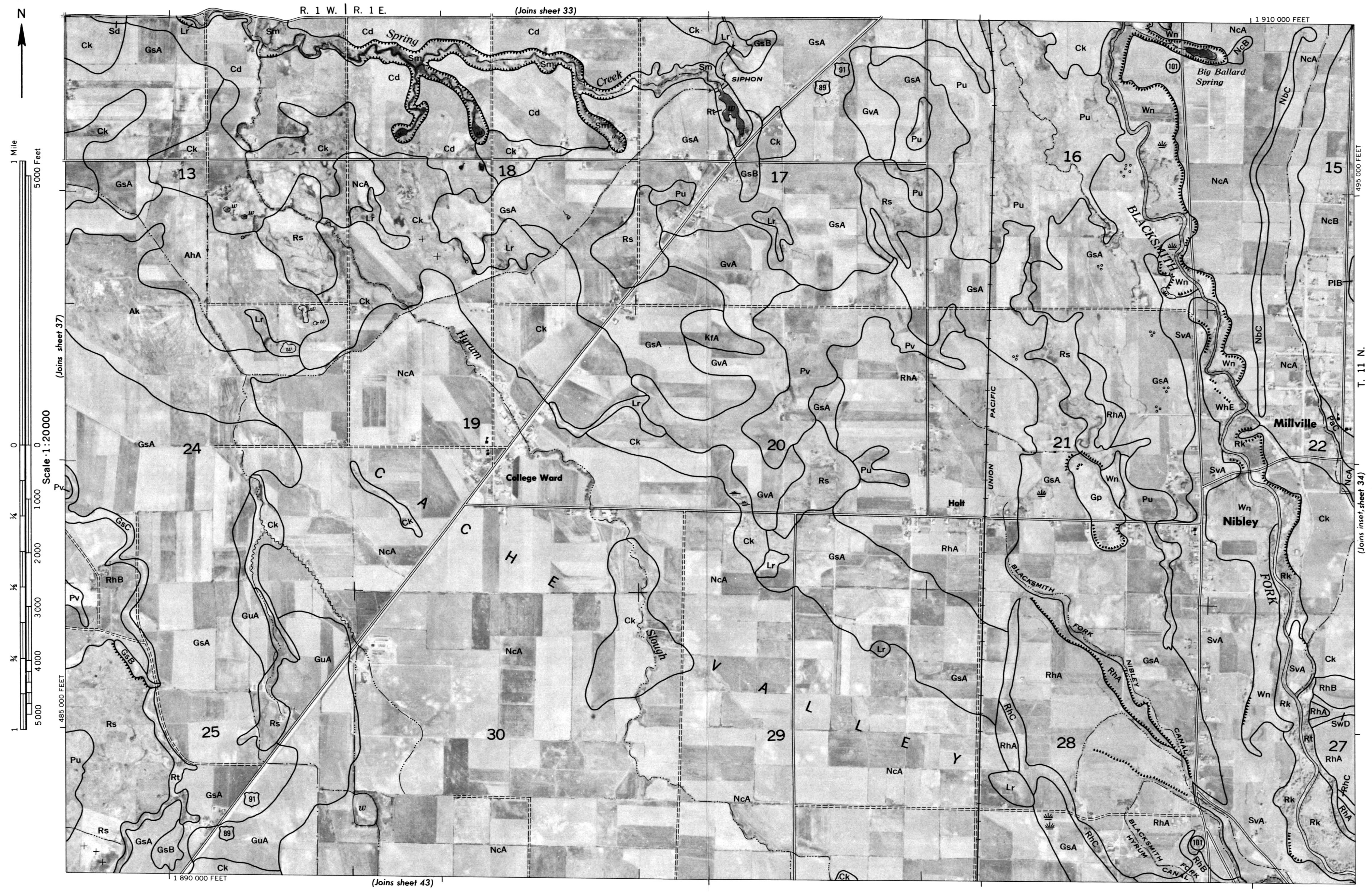
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 37



(38)

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 38



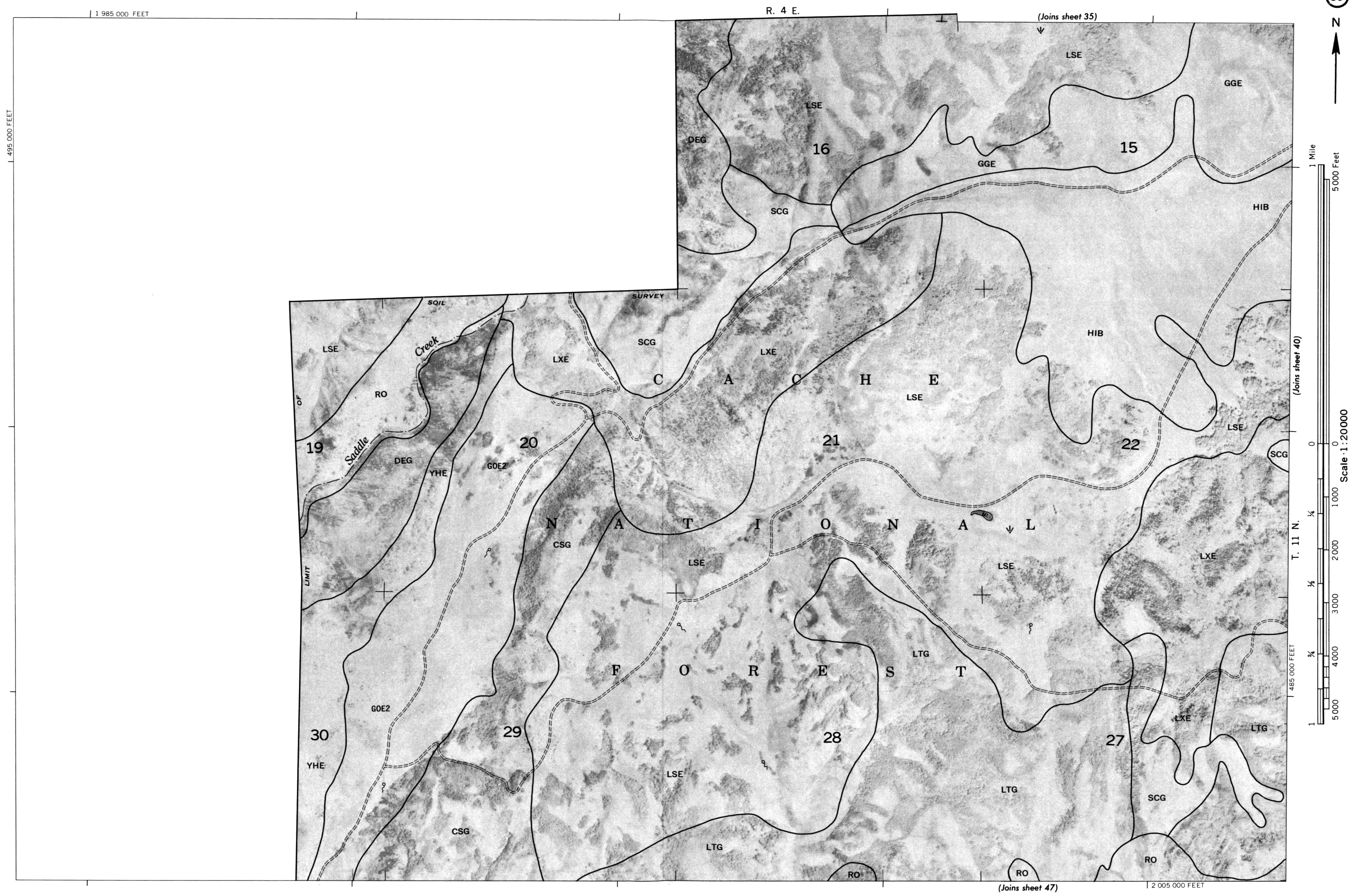
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 38

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 39



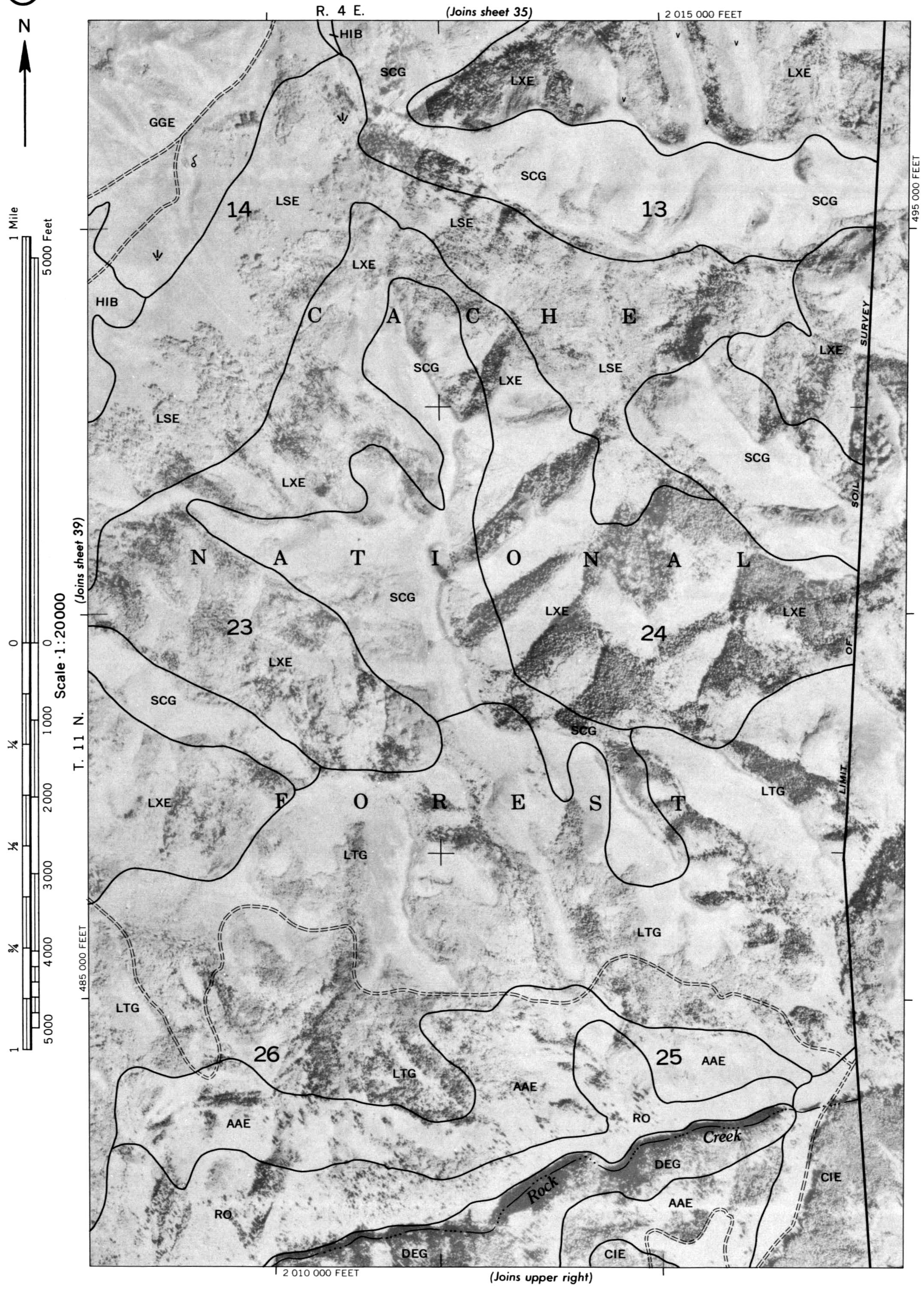
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

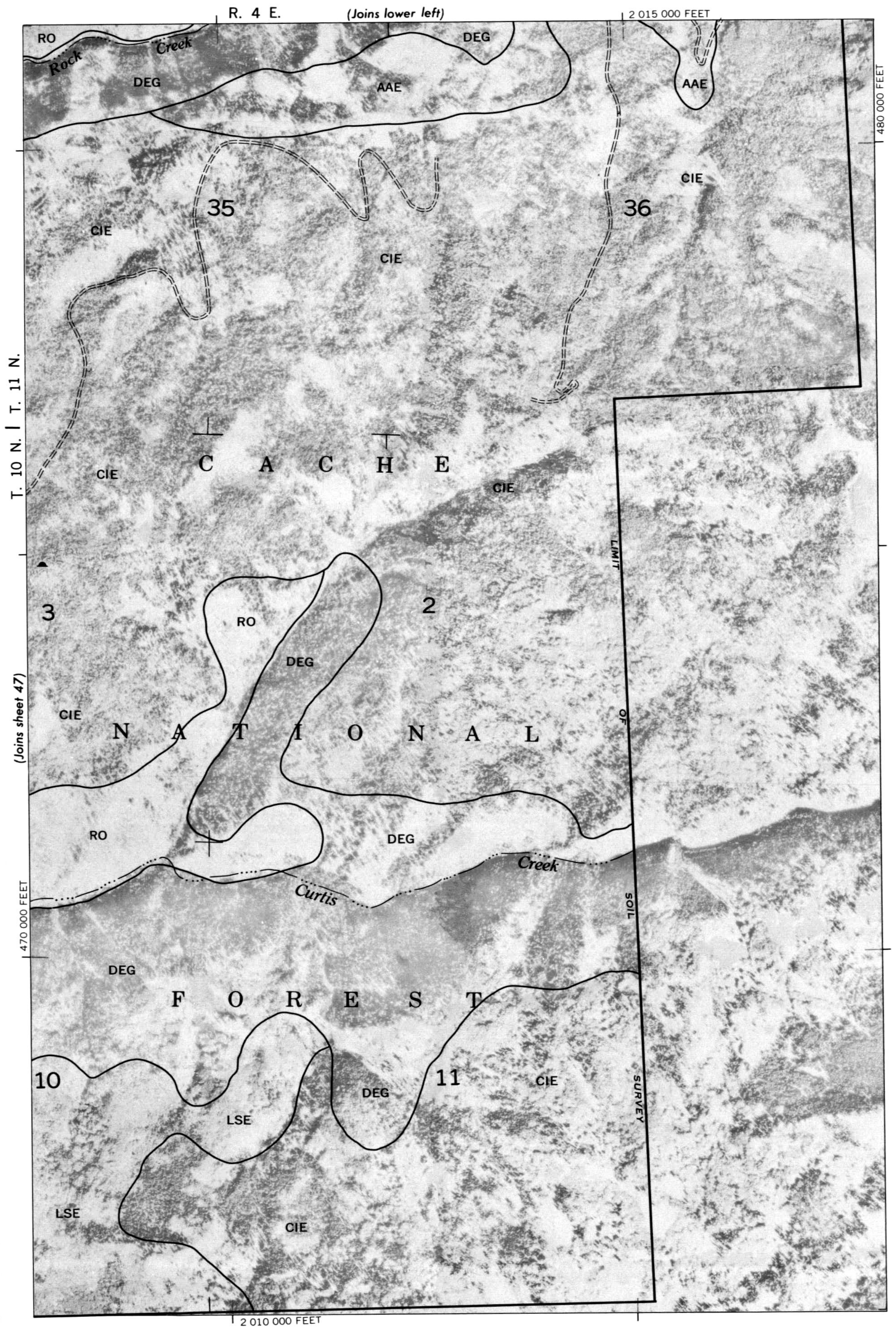
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone

Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 39

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 40





CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 40

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

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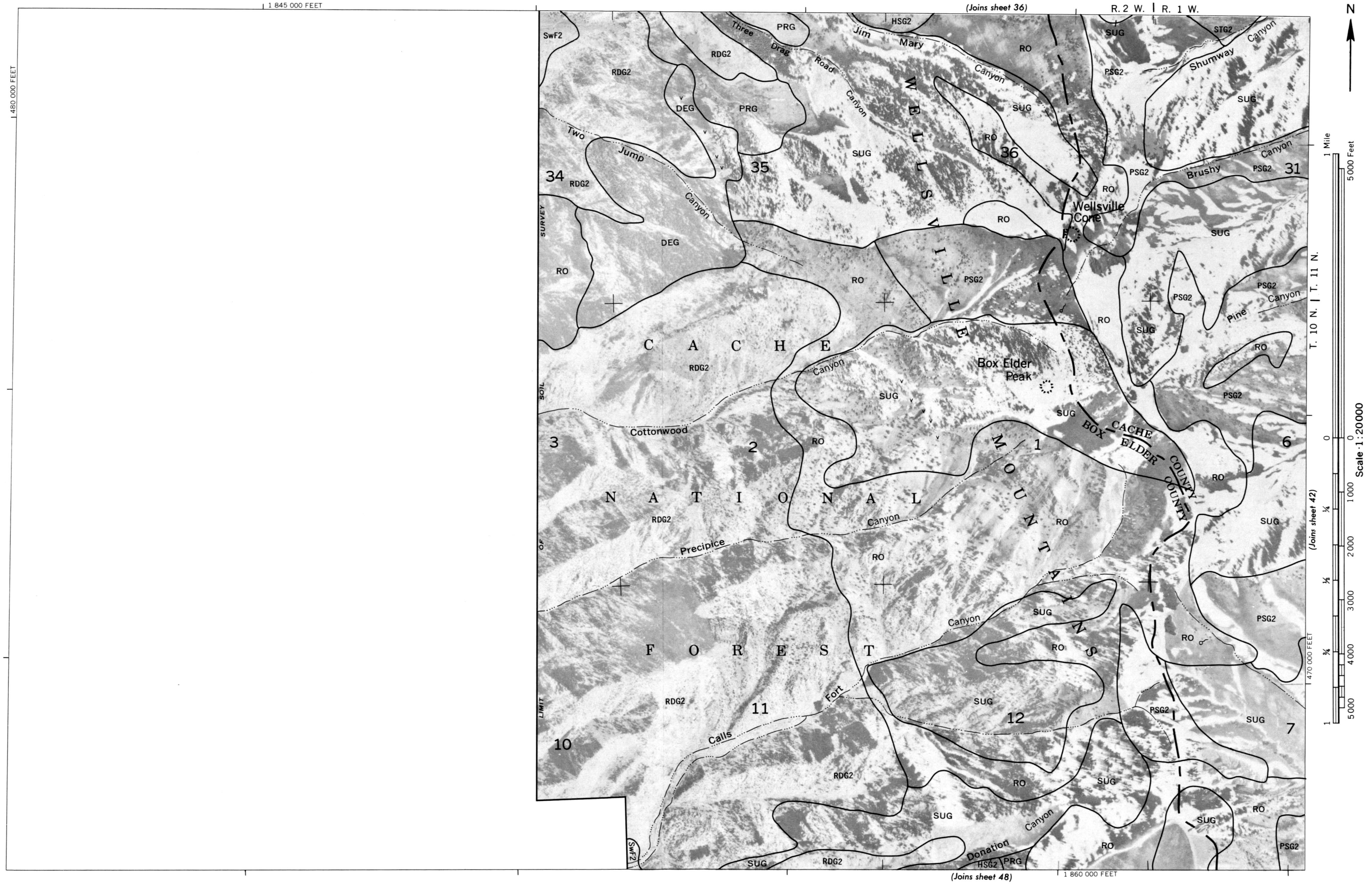
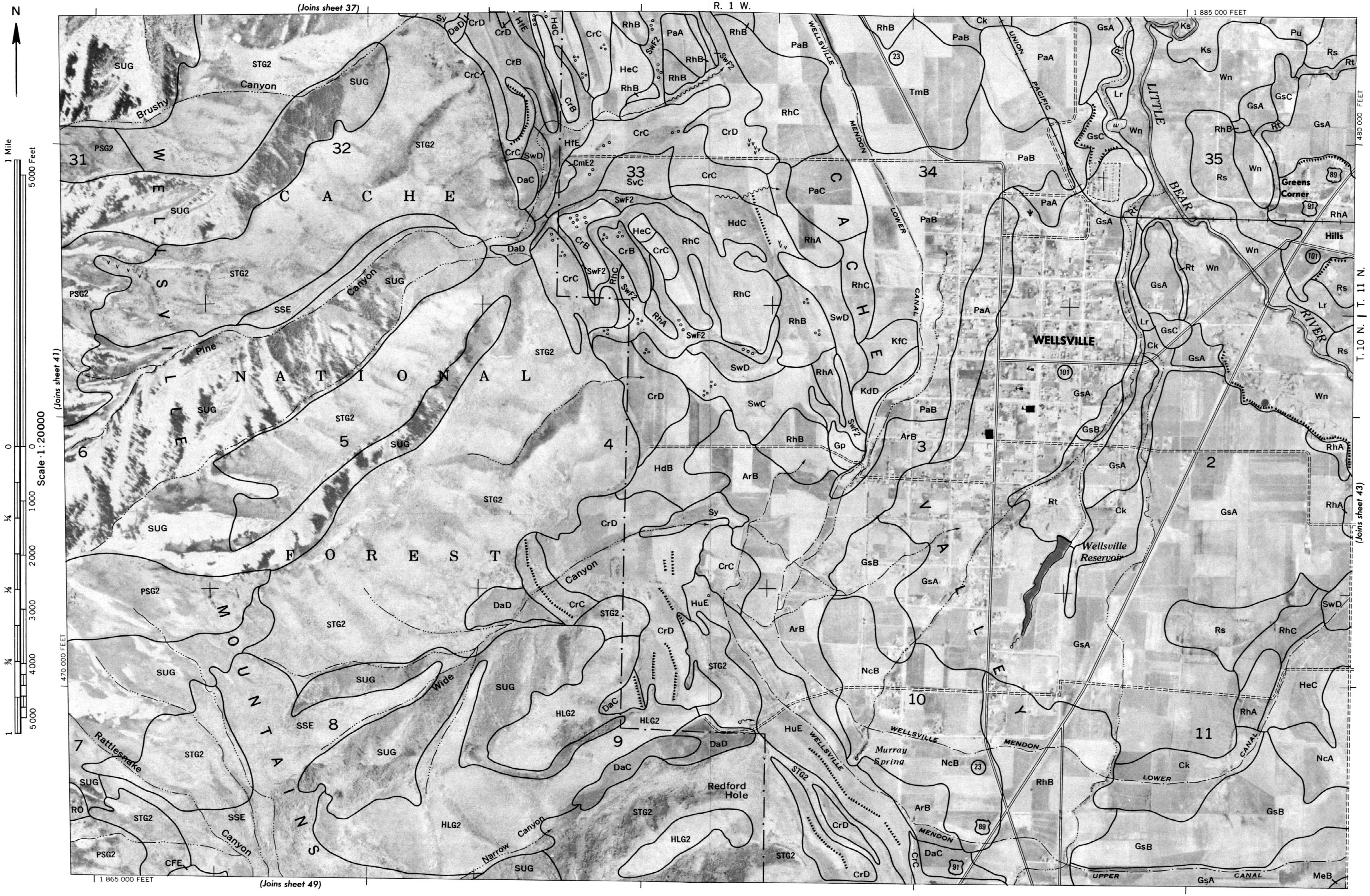
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 41



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 42

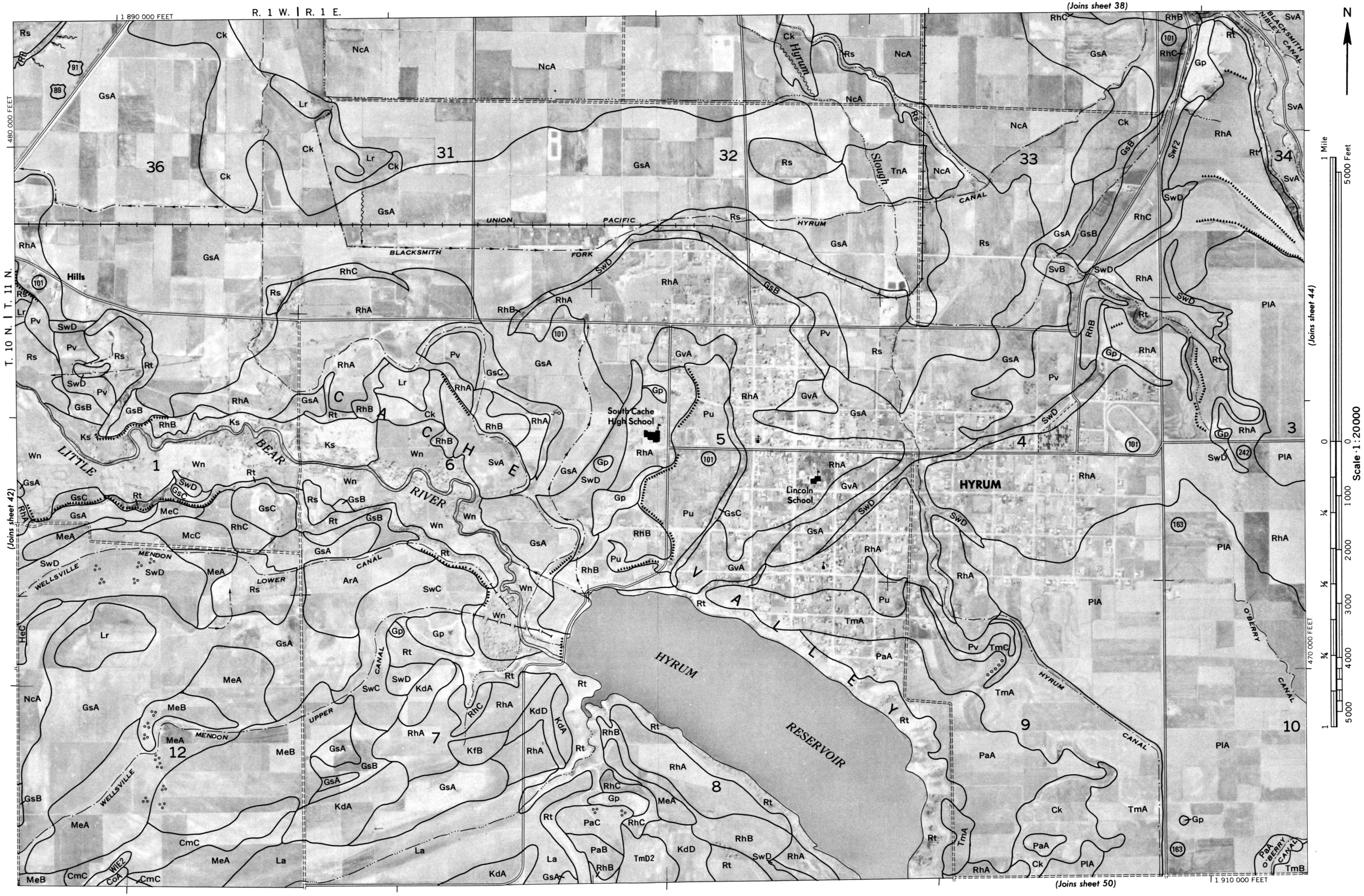


CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 42
Land division corners are approximately positioned on this map.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Utah Agricultural Experiment Station.

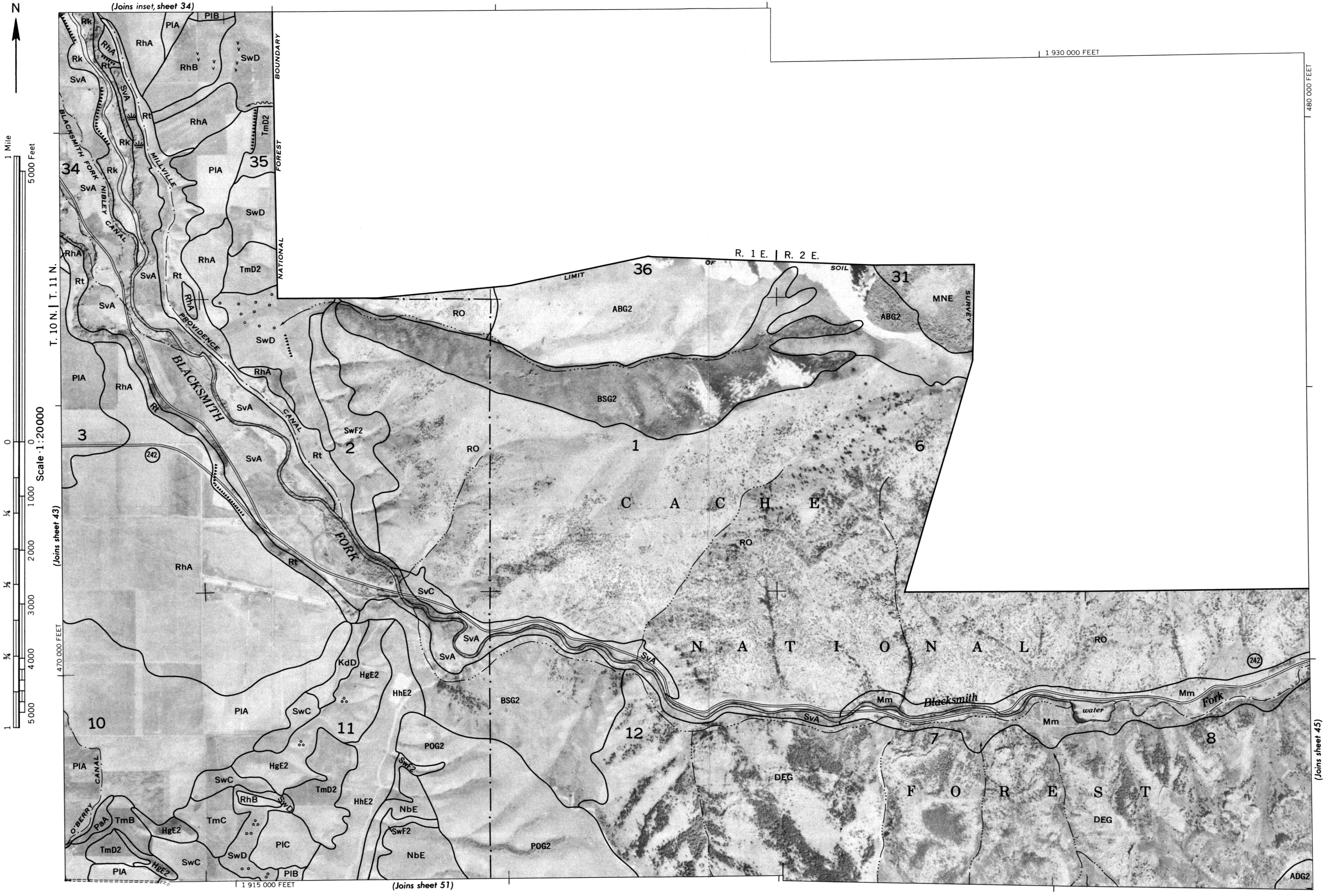
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 43

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 43



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 44



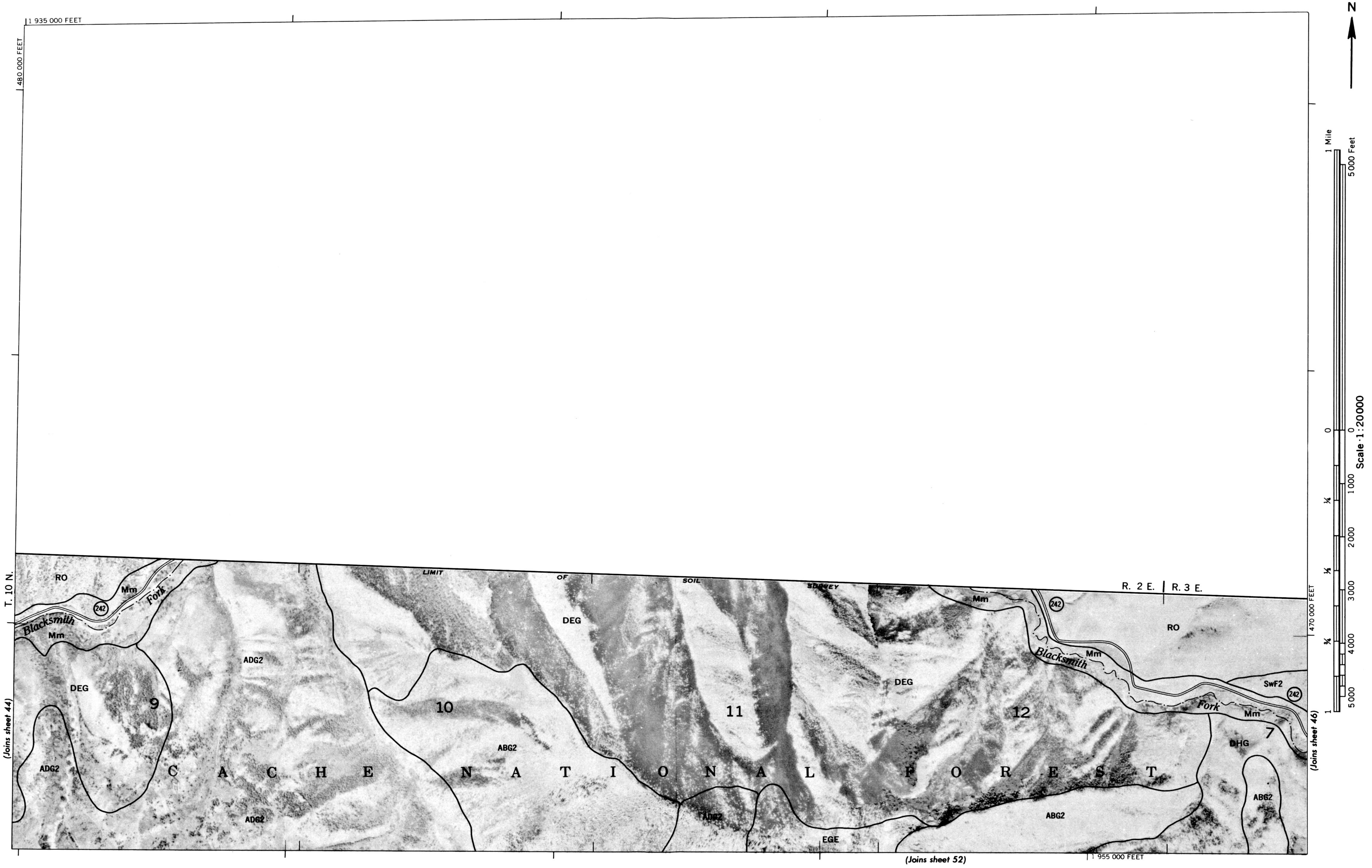
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 44

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

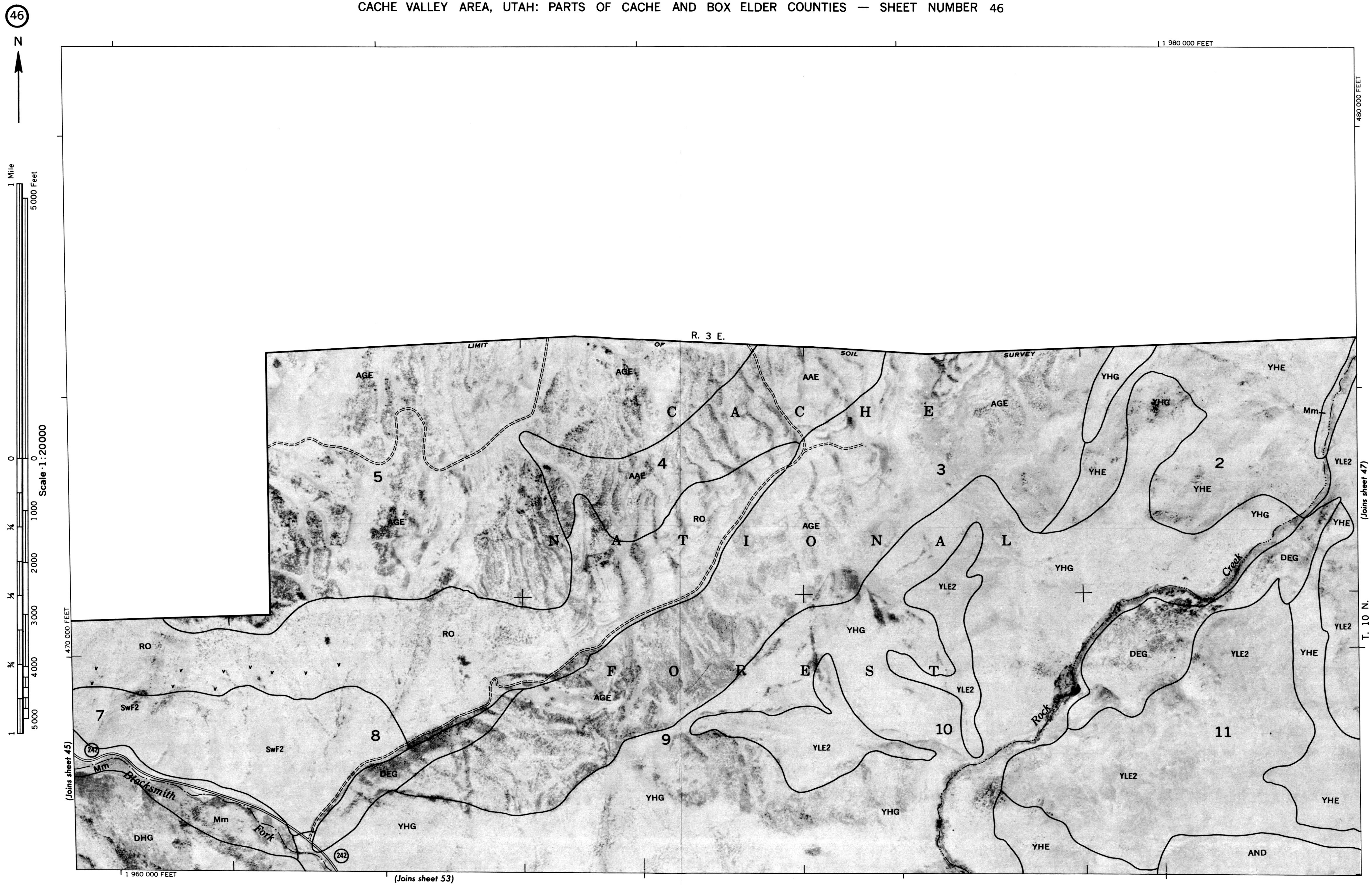
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 45



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDRE COUNTIES NO. 45



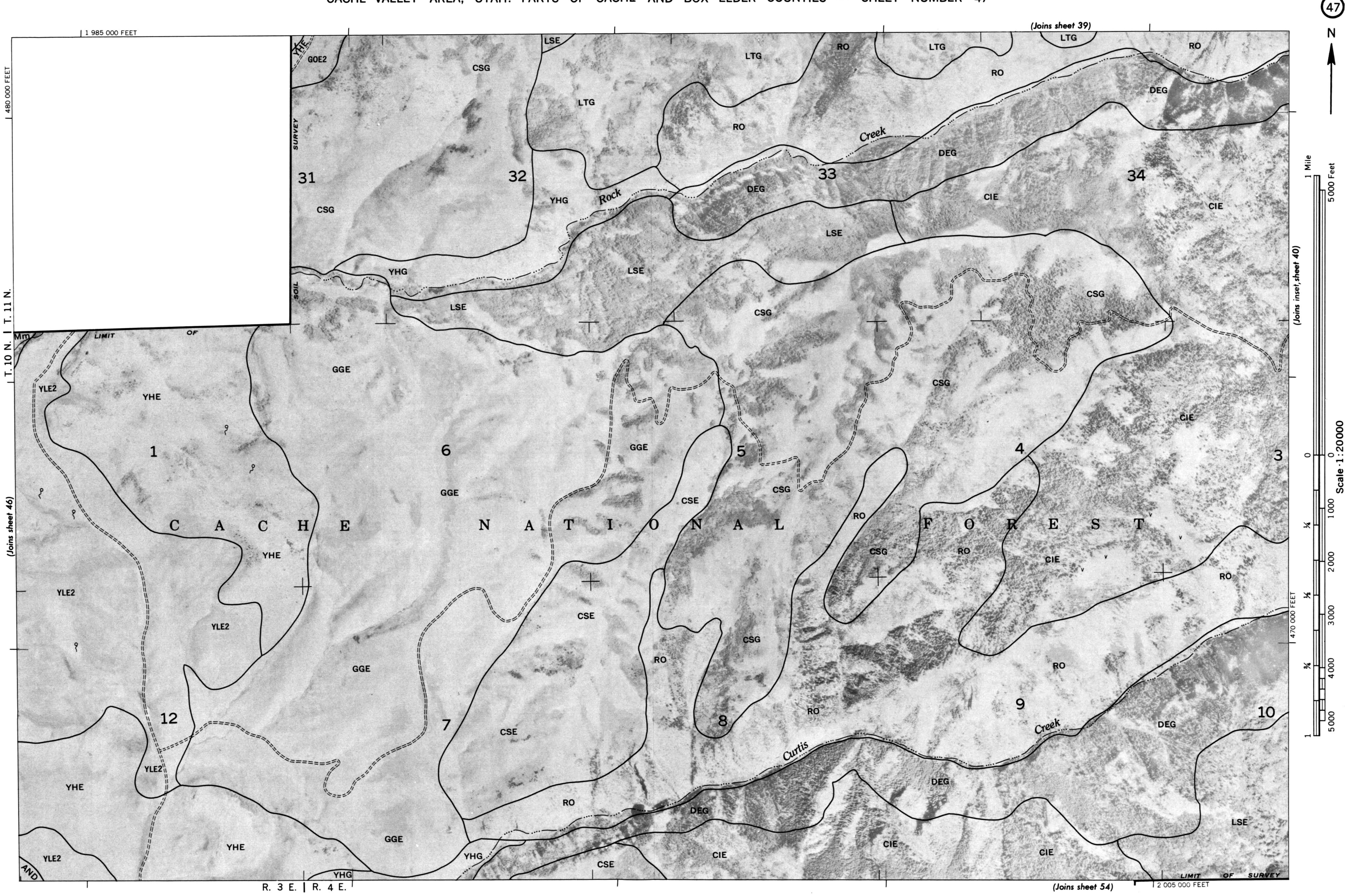
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 46

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

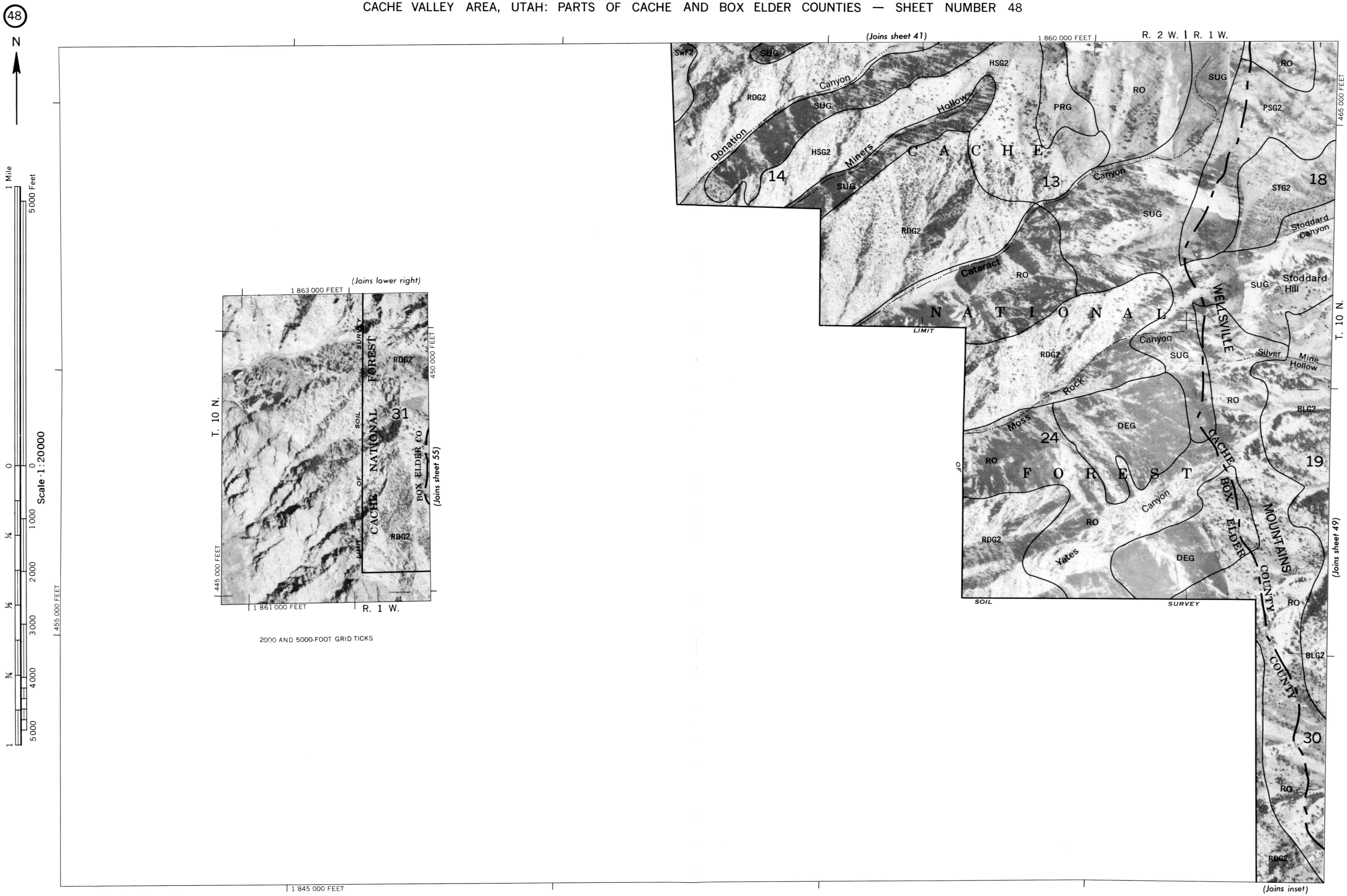
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 47



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 47

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 48



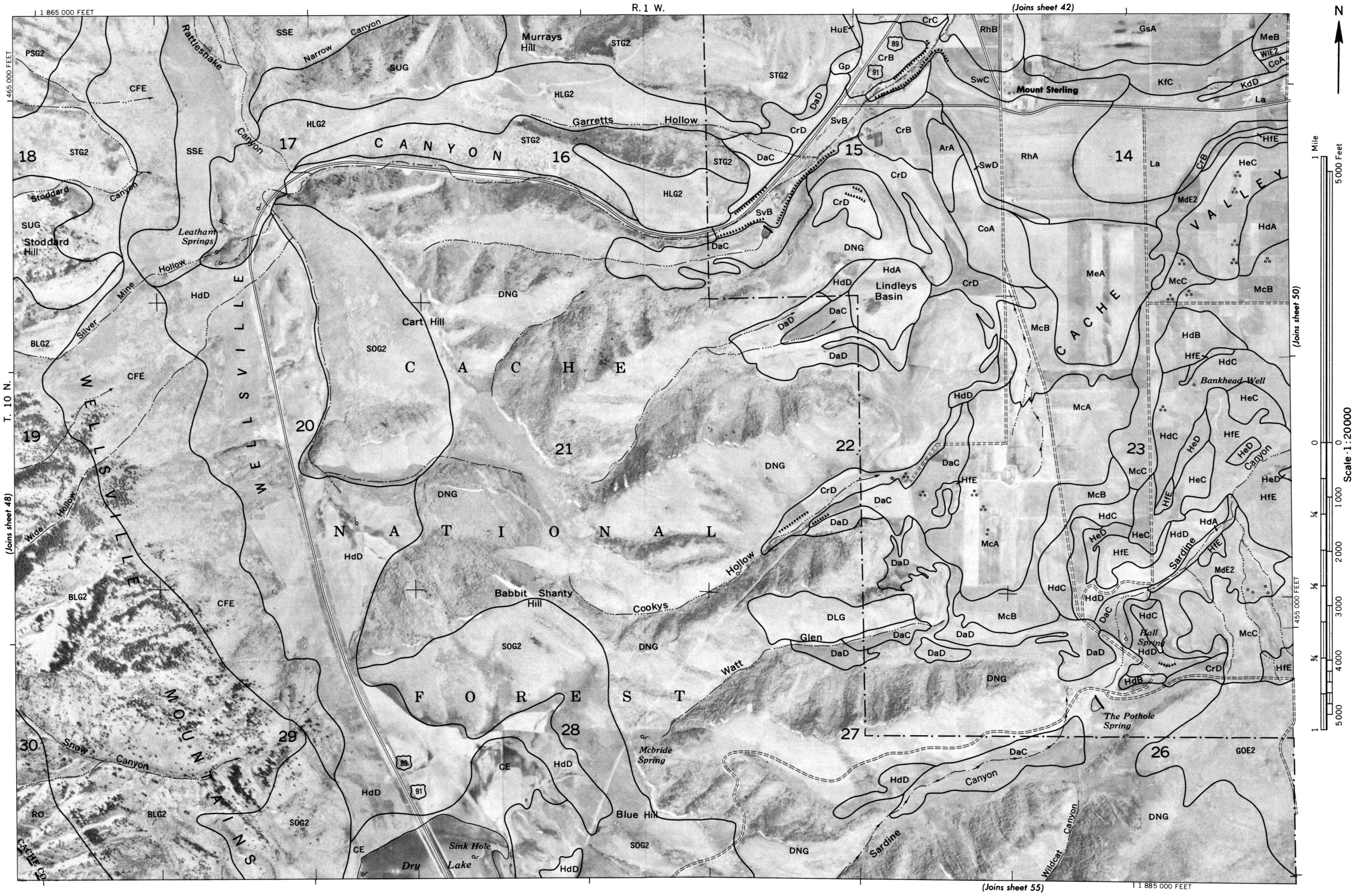
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 48

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 49



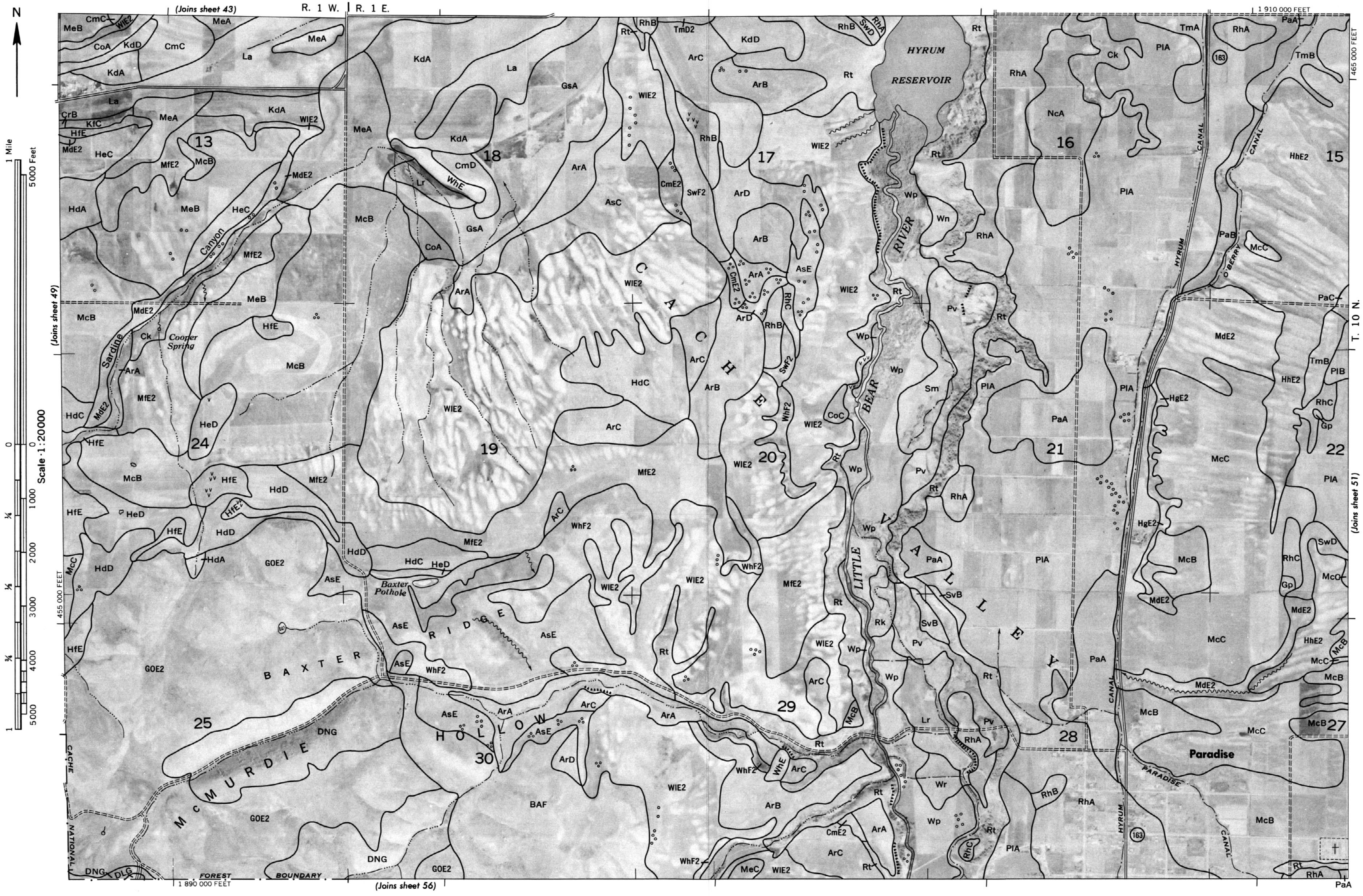
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

Land division corners are approximately positioned on this map.

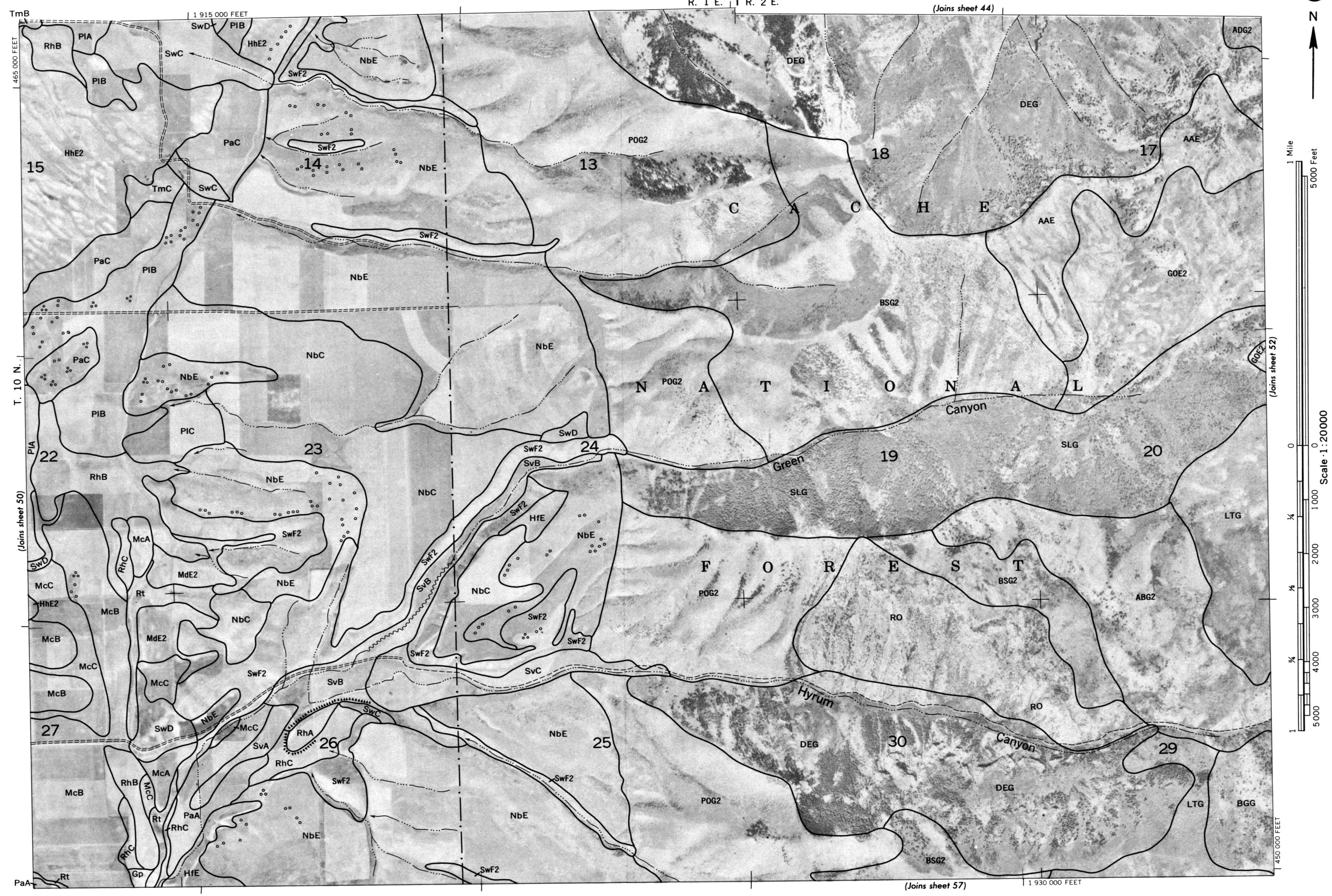
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 49

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 50



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 50
Land division corners are approximately positioned on this map.
Photobase from 1963 and 1956 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

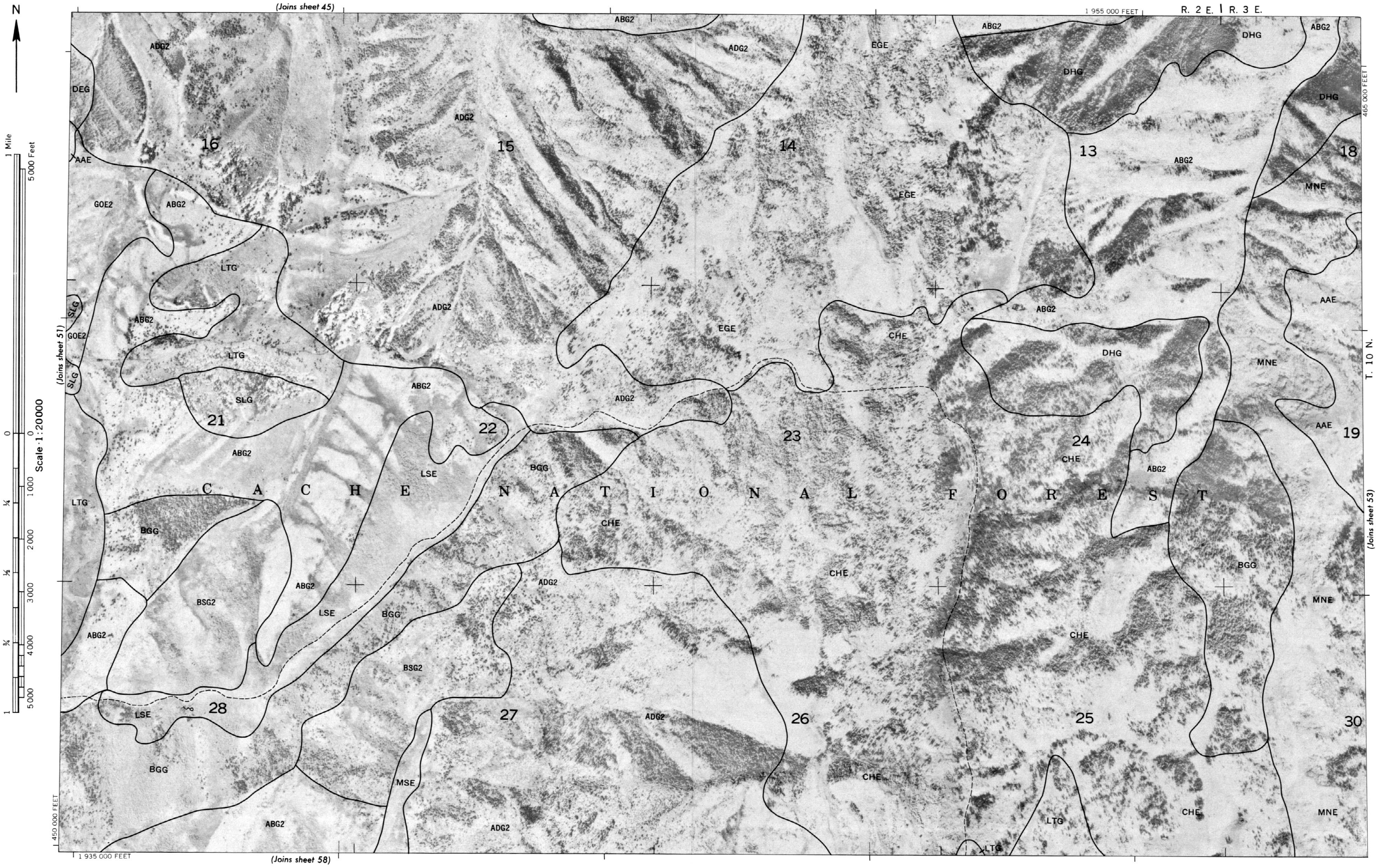
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 51



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 51

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 52



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 52

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

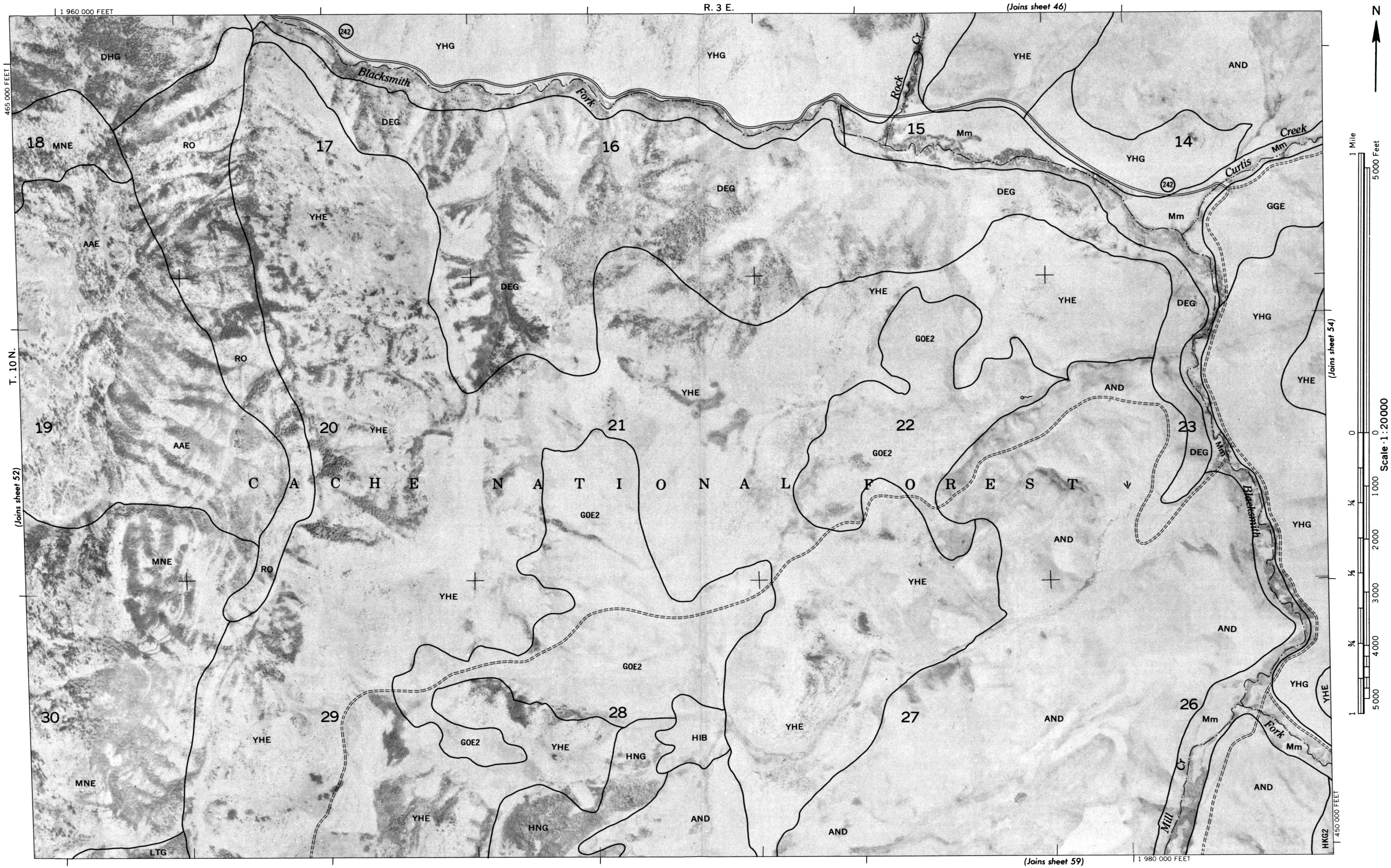
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 53

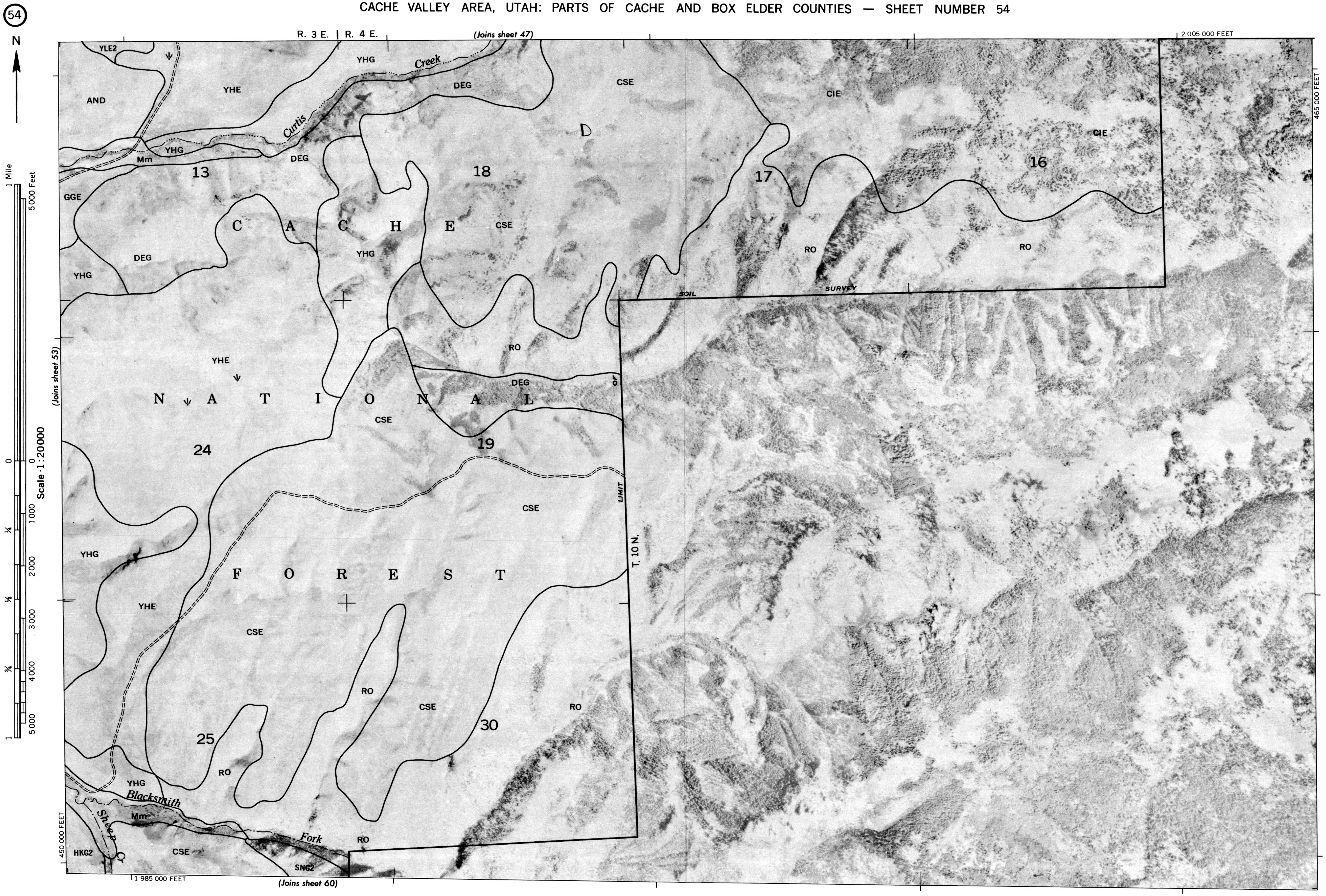
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

Land division corners are approximately positioned on this map.



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 54



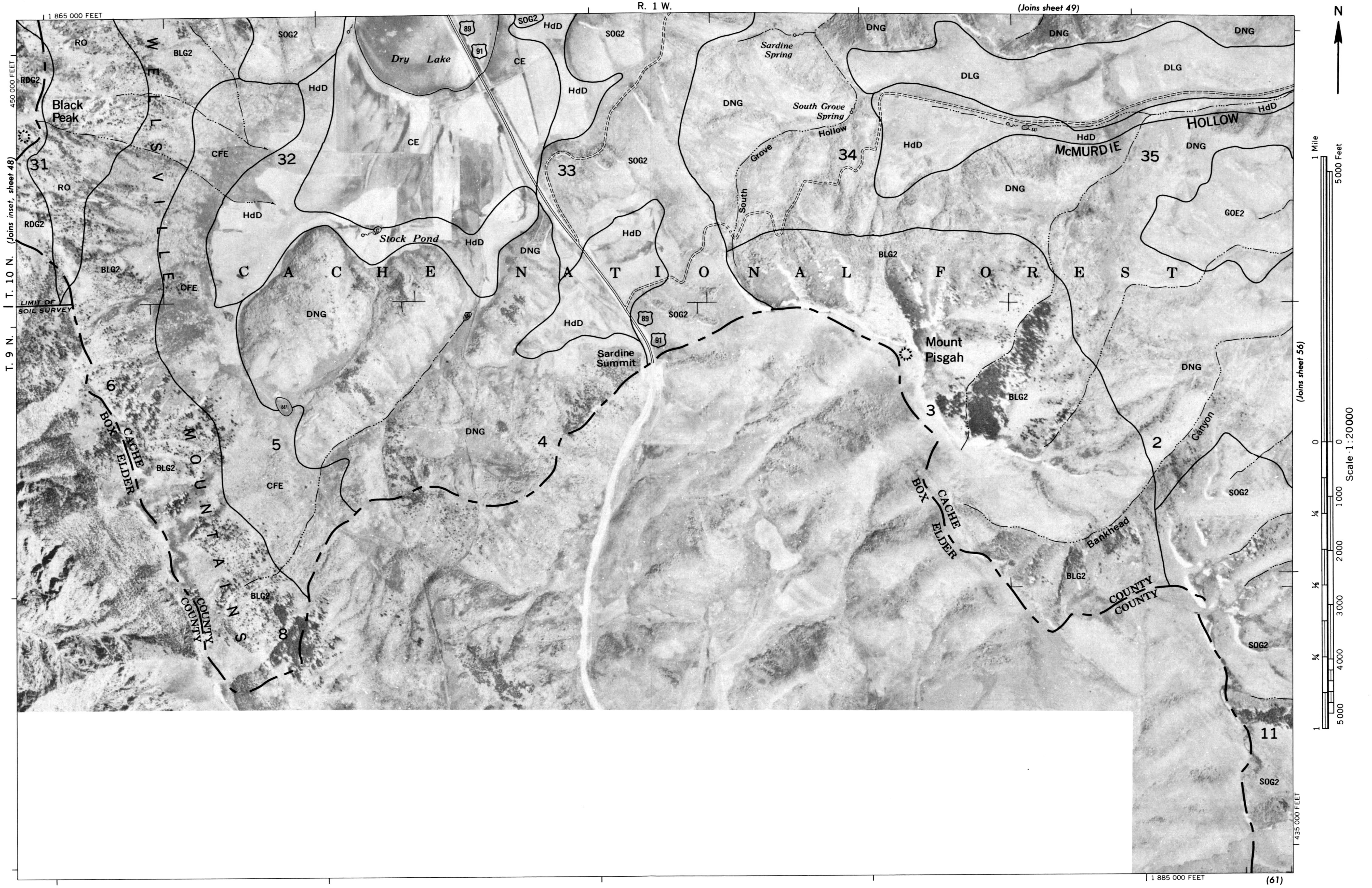
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 54

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 55

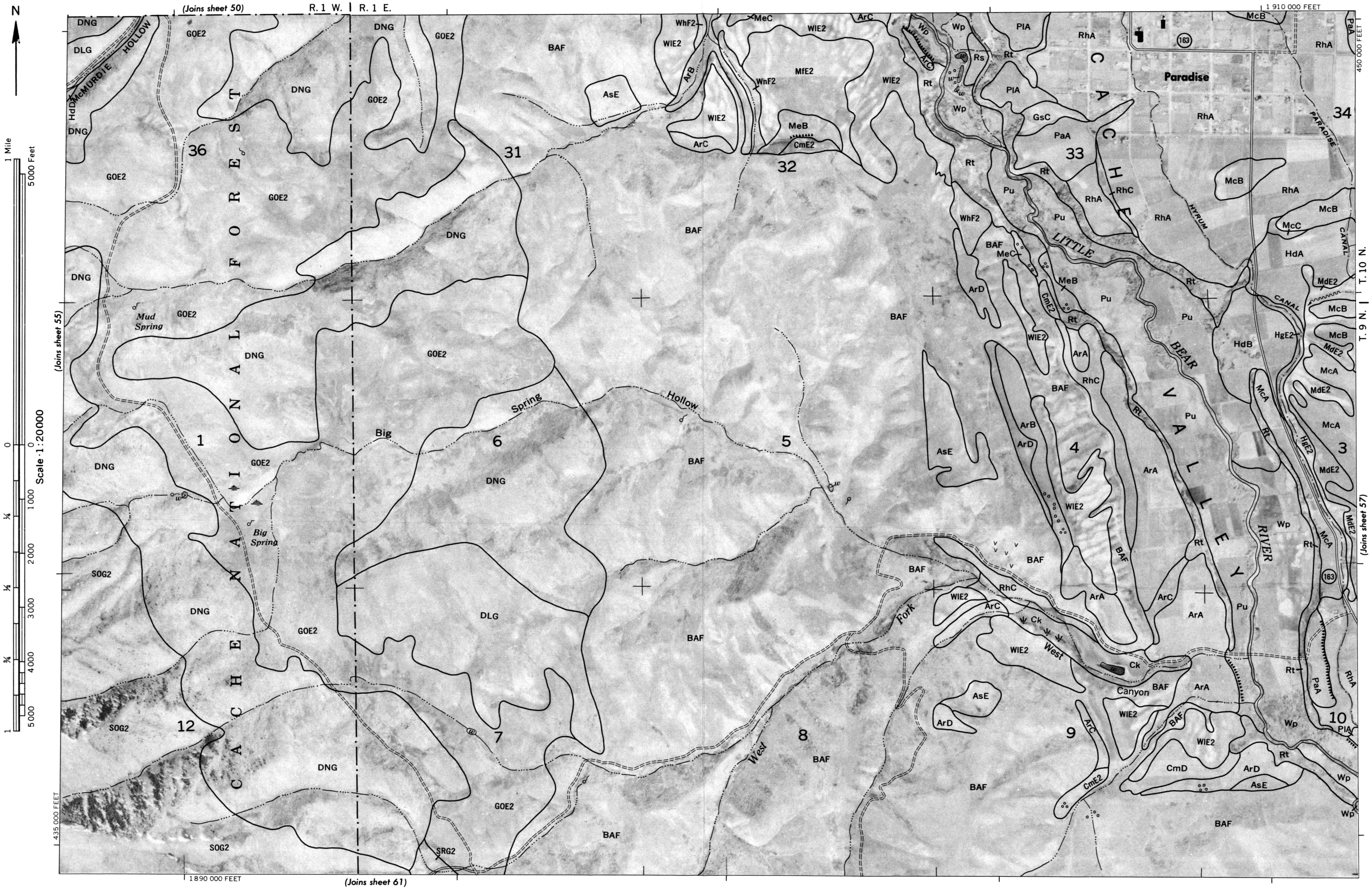


his map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 55

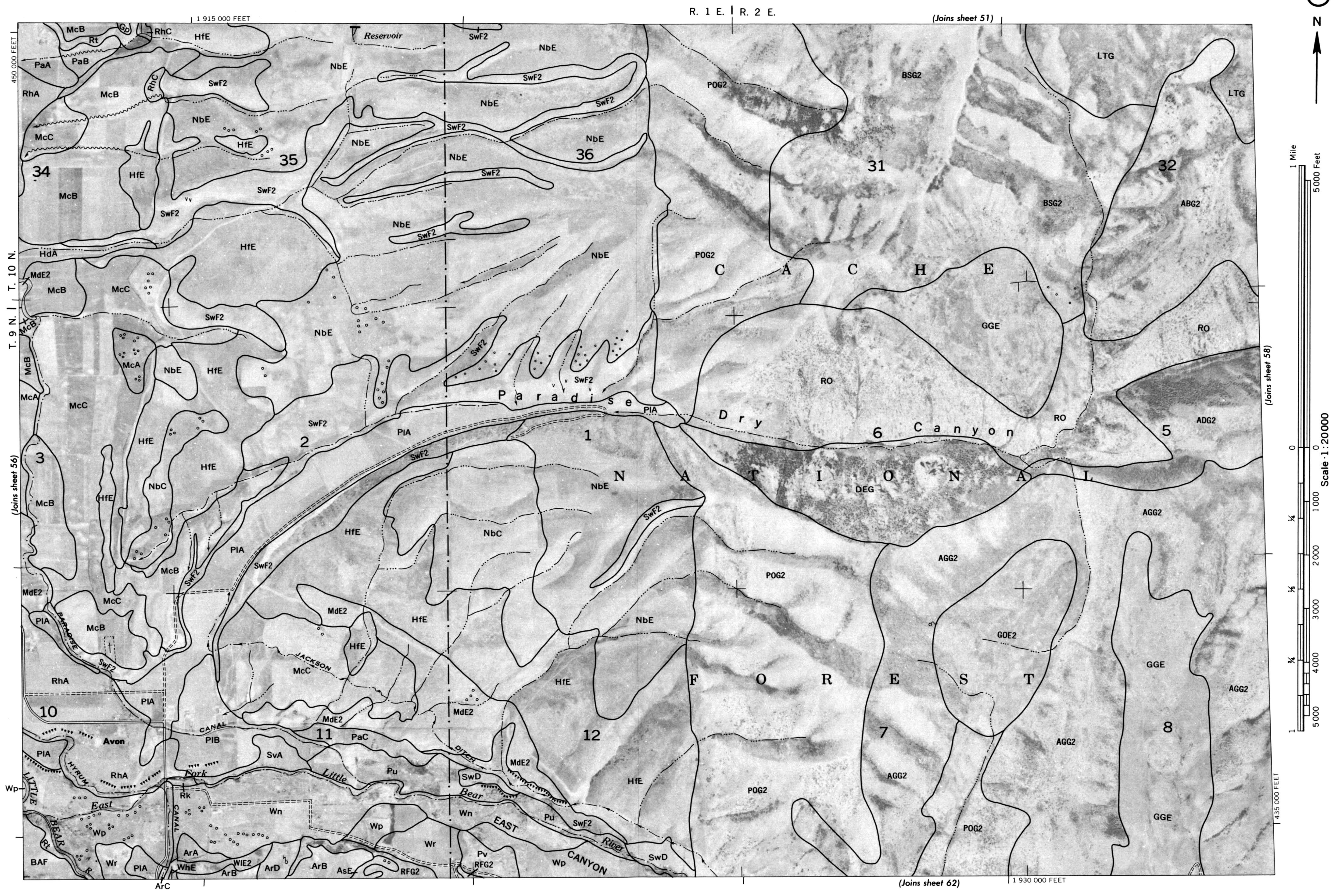
(56)

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 56



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 56
Land division corners are approximately positioned on this map.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 57

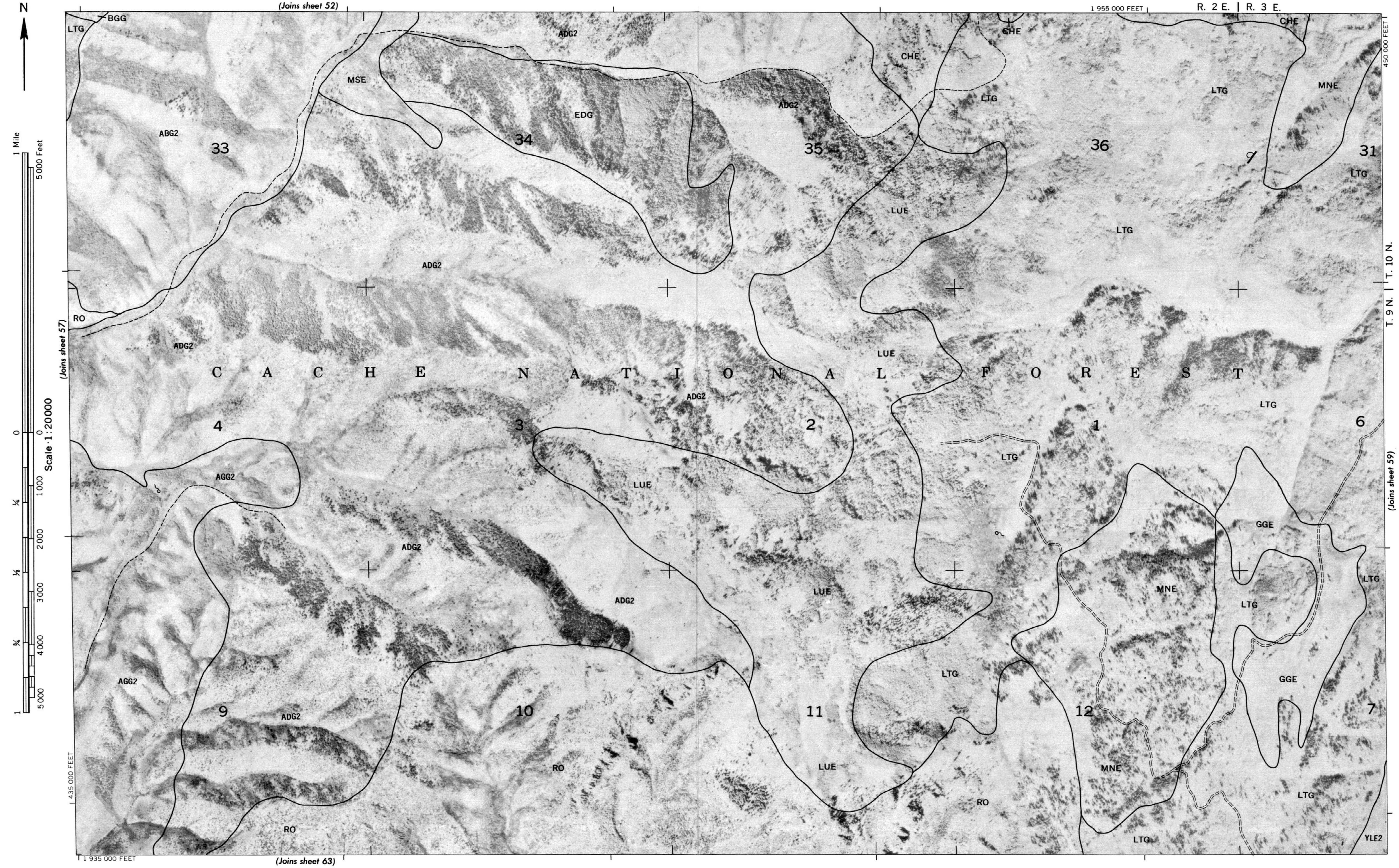


This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 57

(58)

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 58



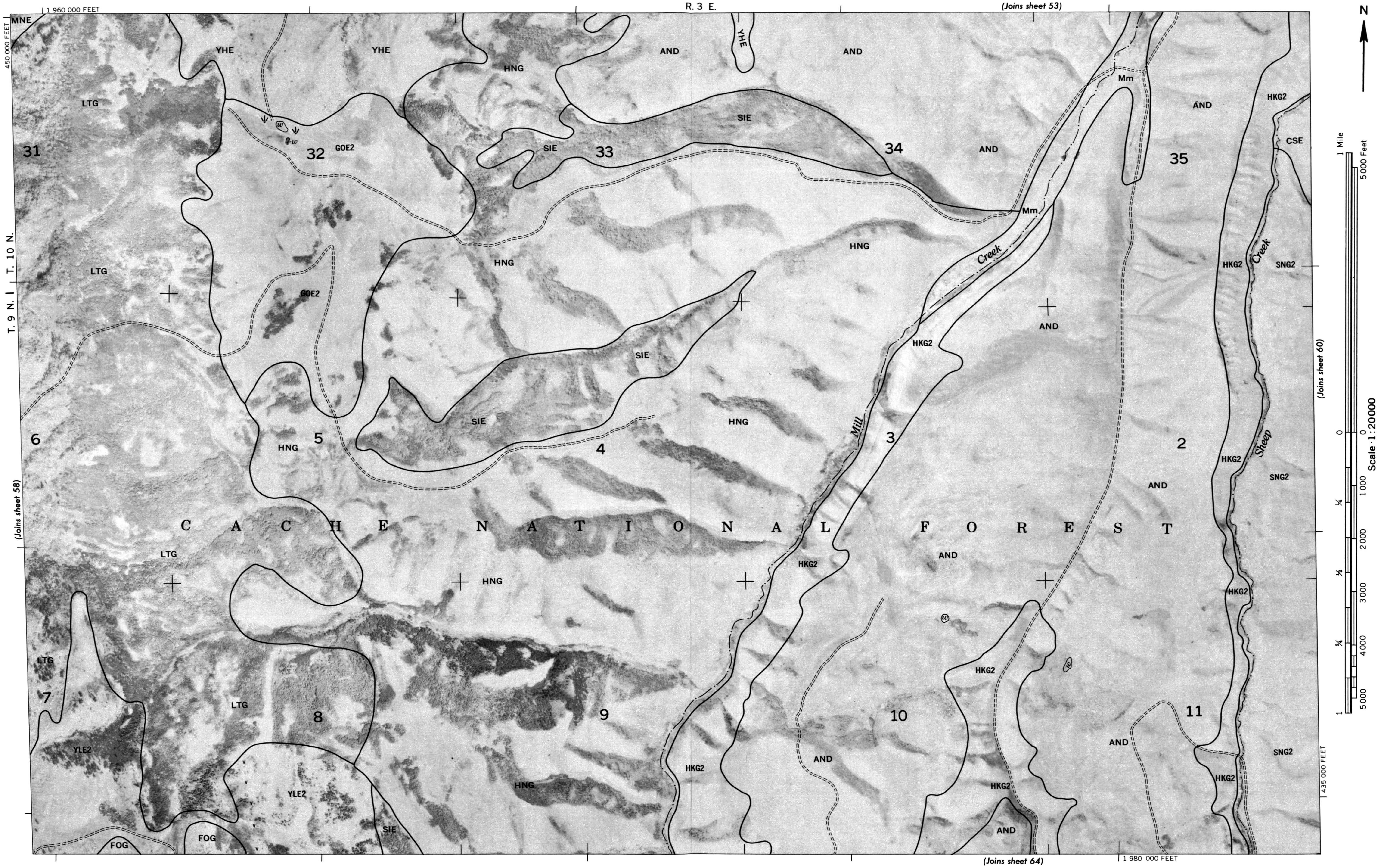
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 58

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 59



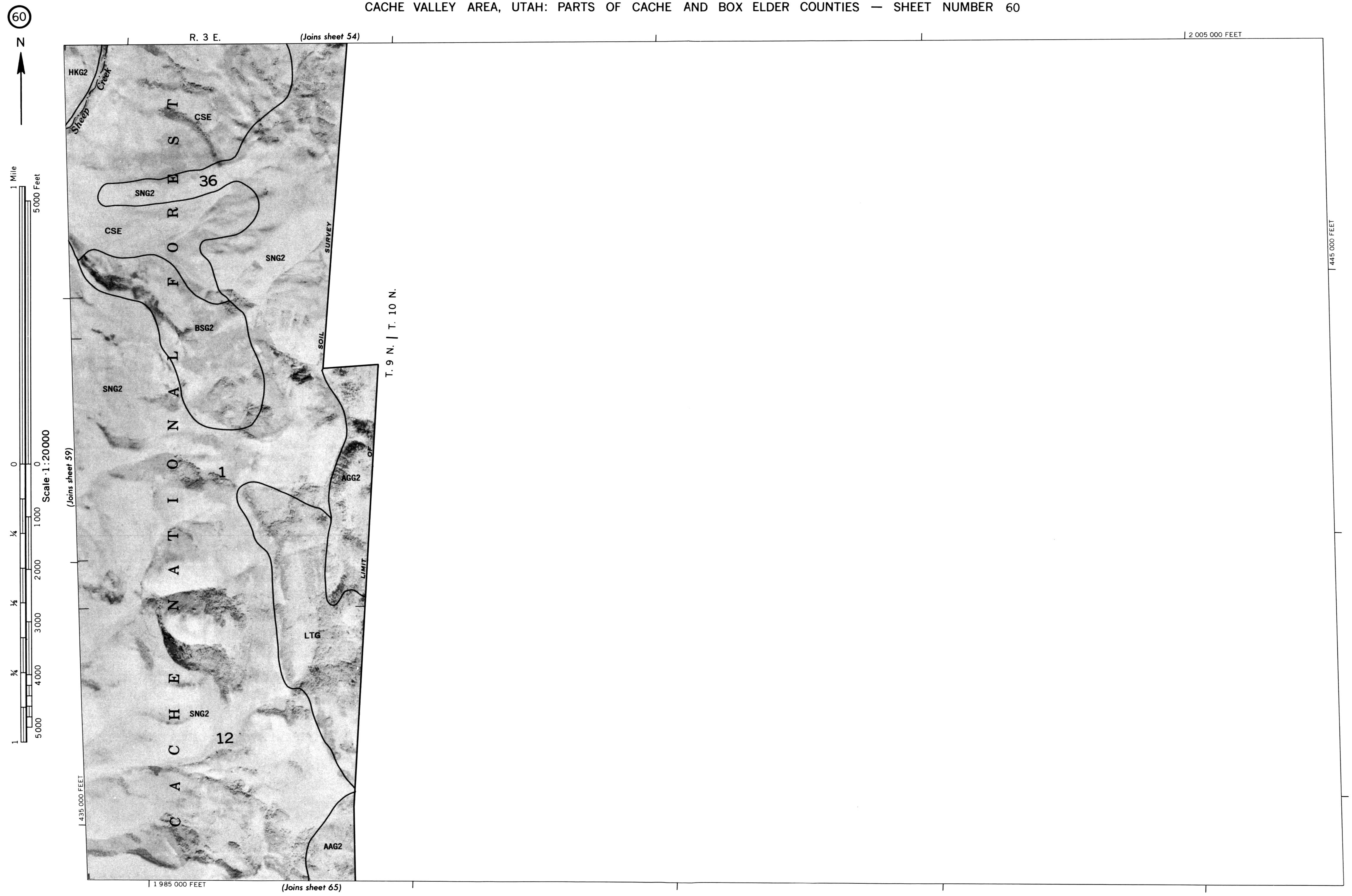
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone

Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 59

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 60



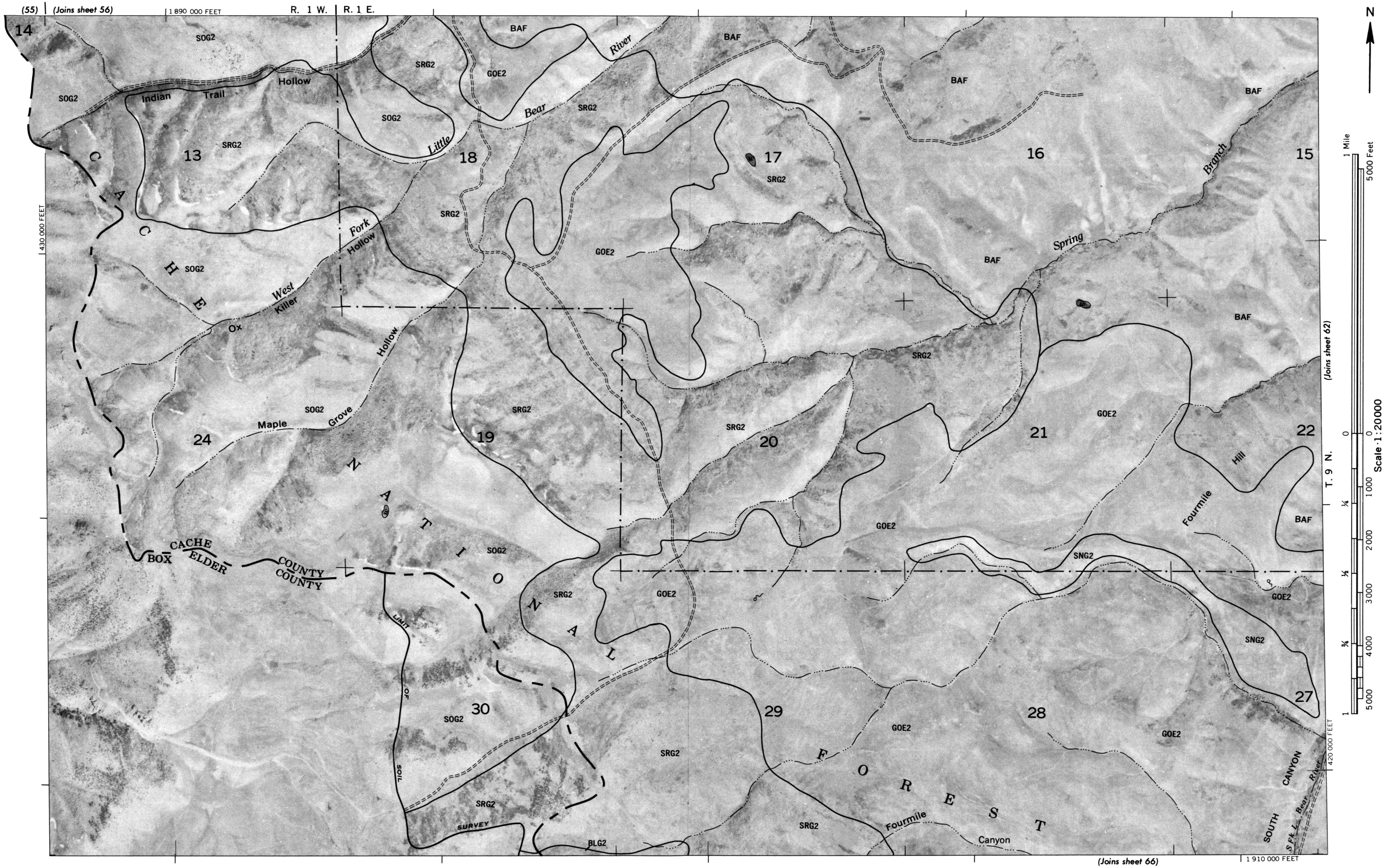
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 60

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

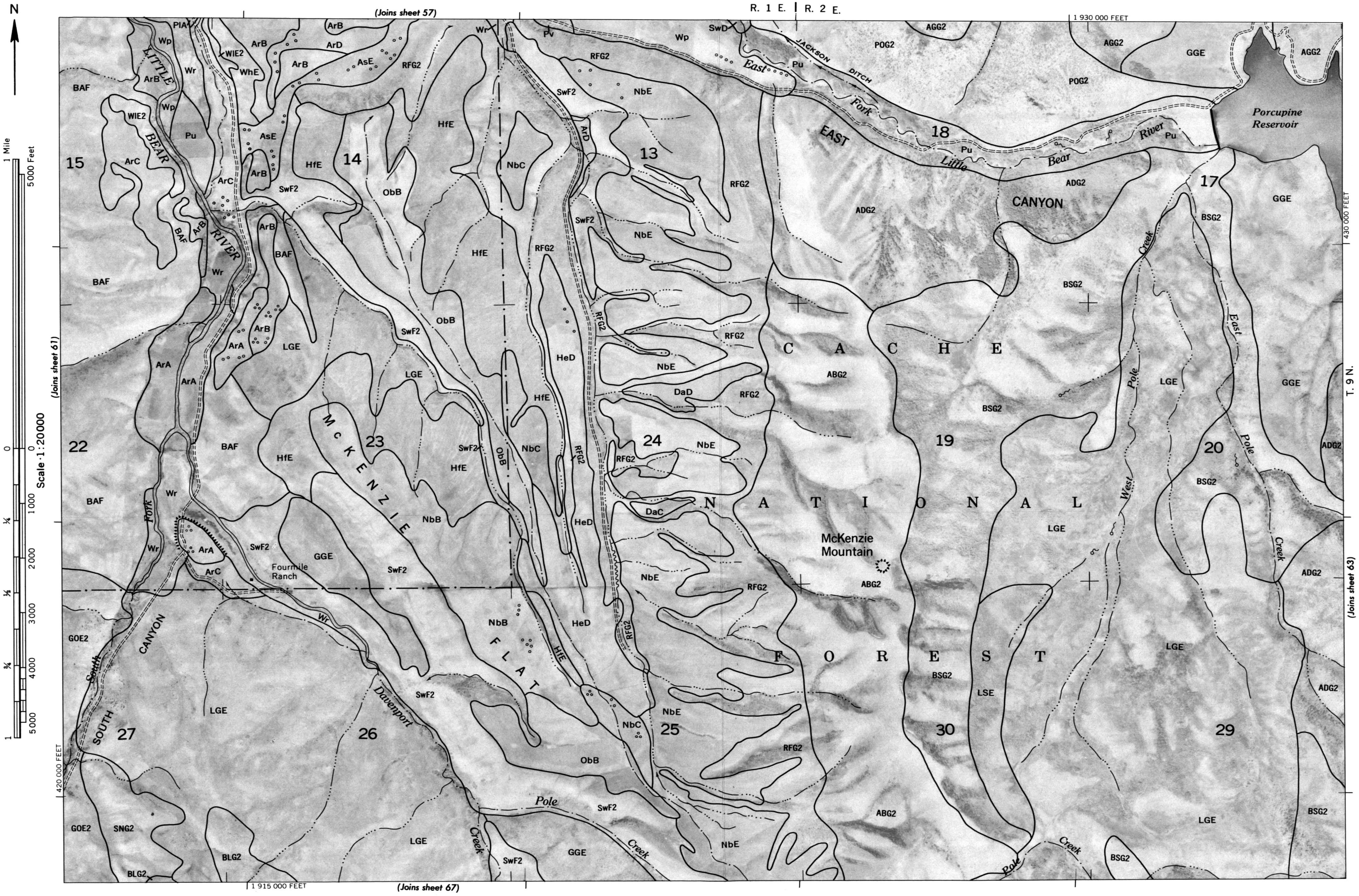
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 61



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 61

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 62



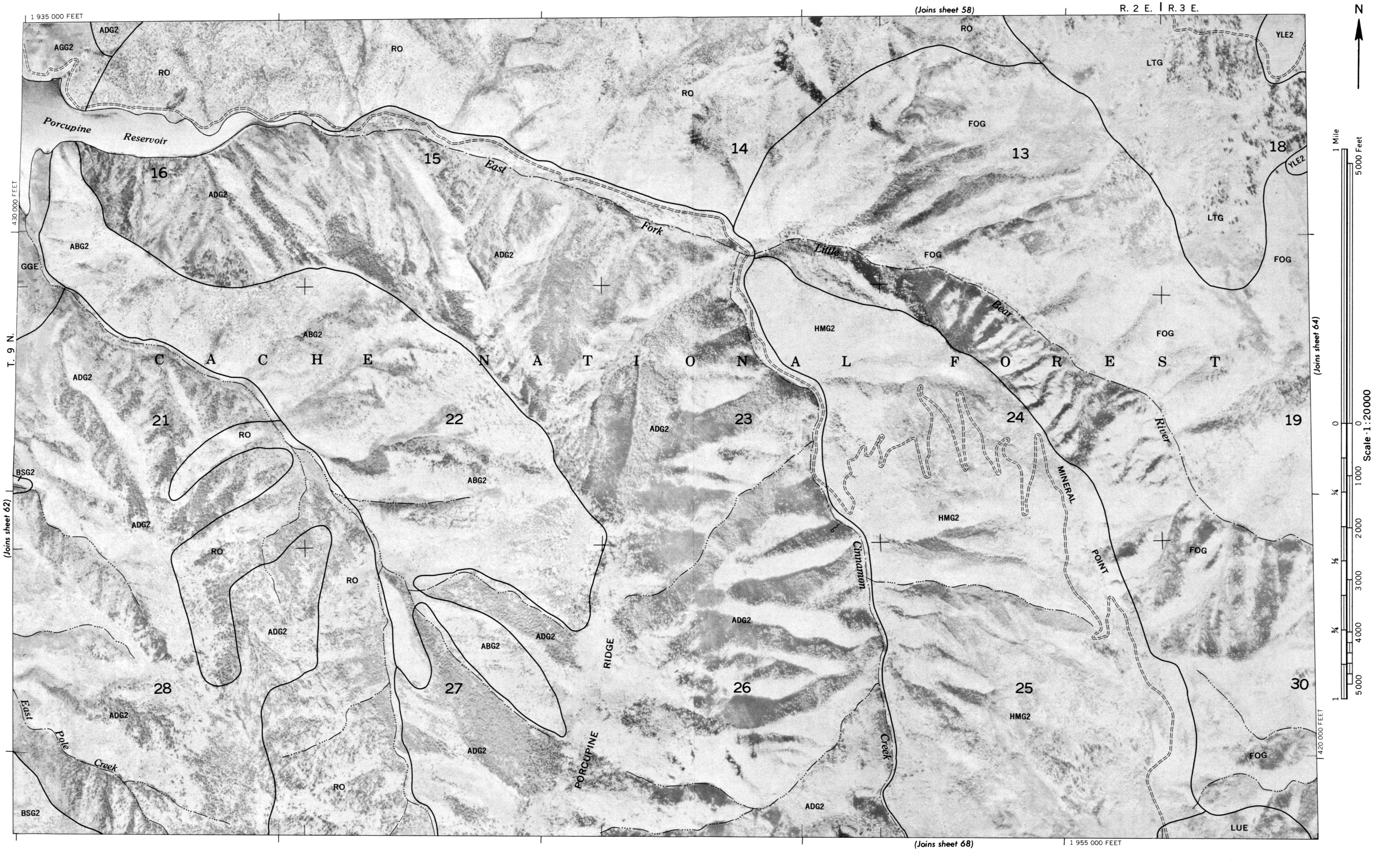
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 62

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 63



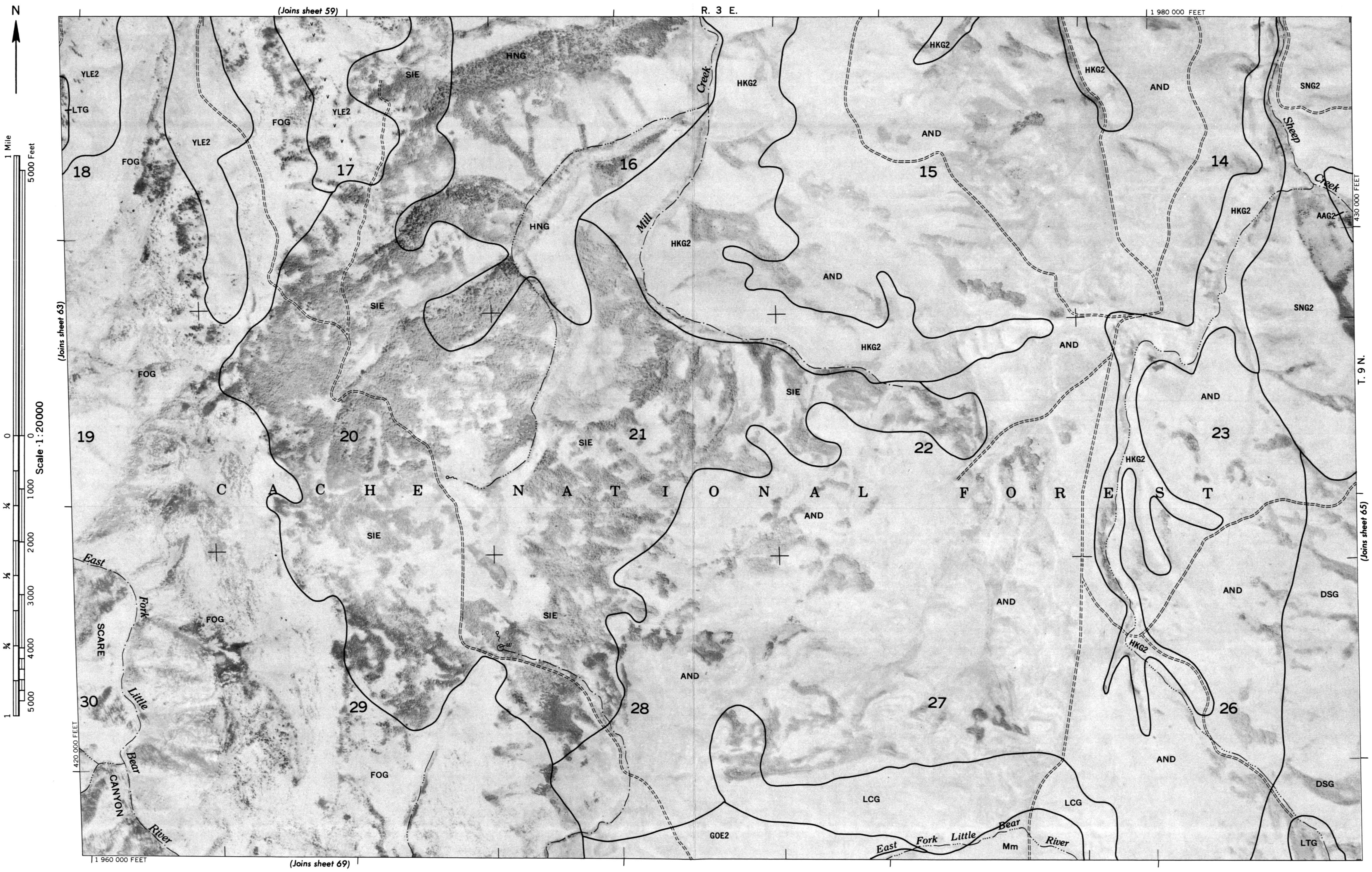
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 63

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 64



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 64

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

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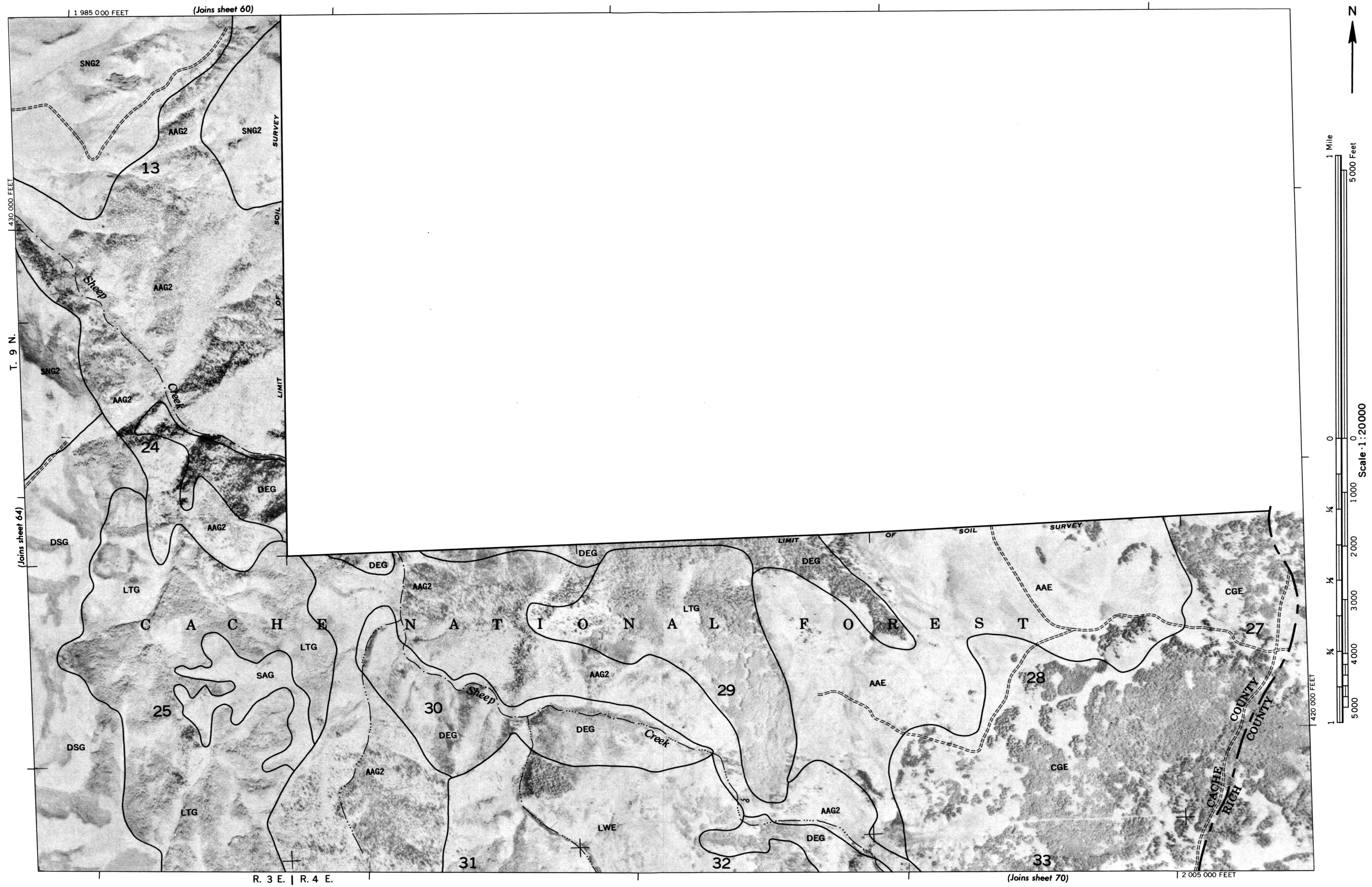
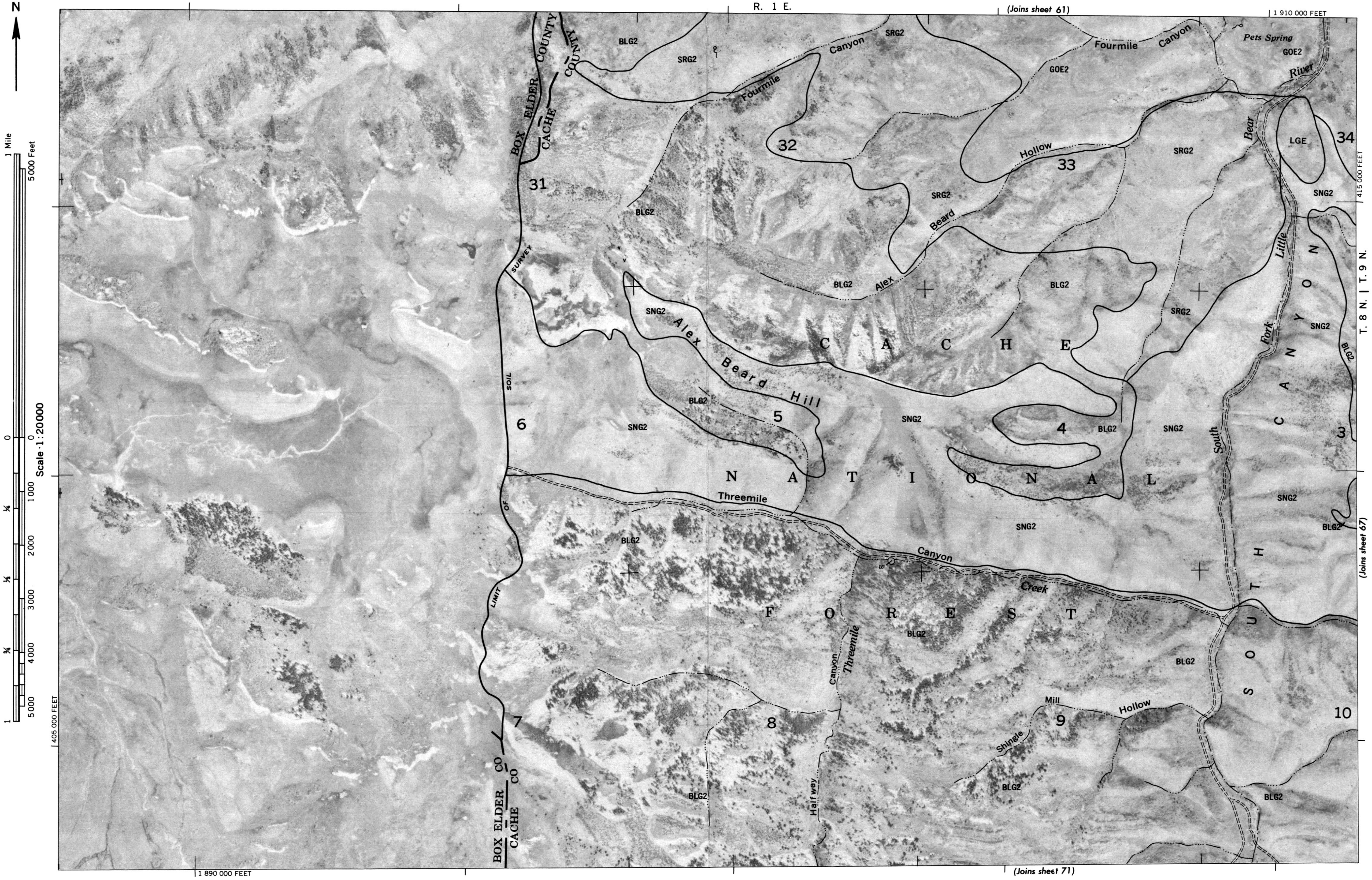
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 66



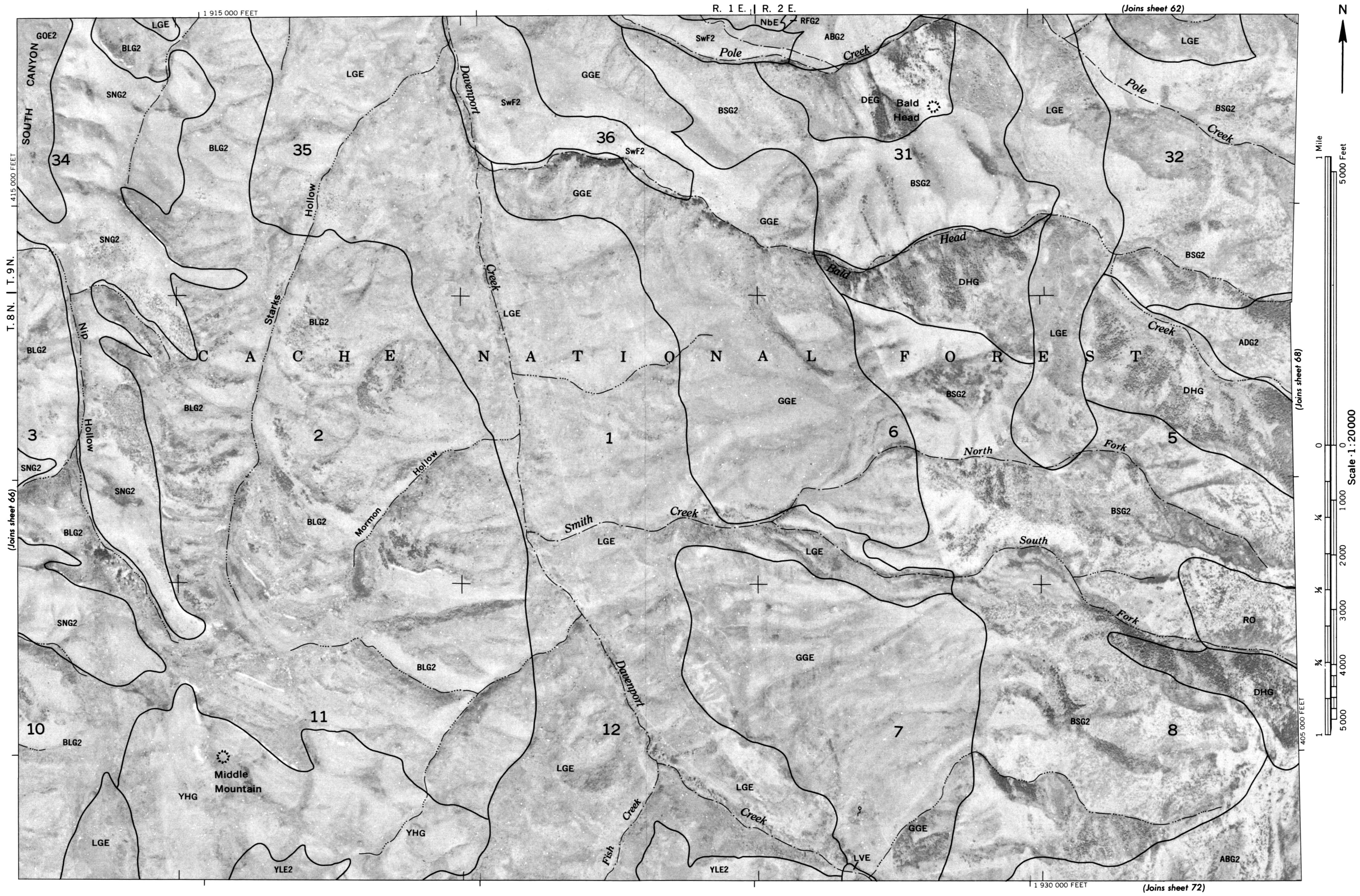
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 66

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

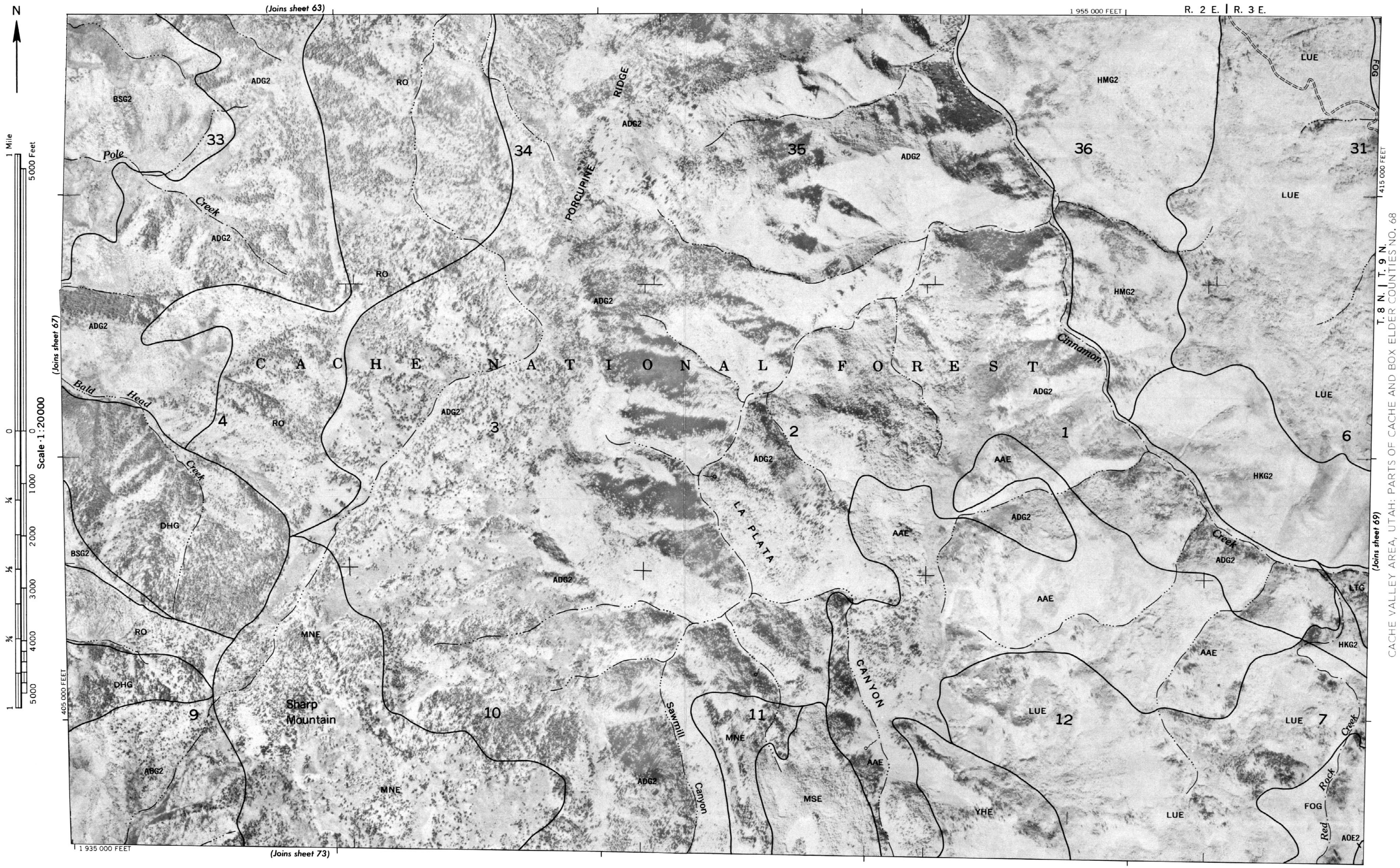
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 67



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

(68)

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 68



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 68

Land division corners are approximately positioned on this map.

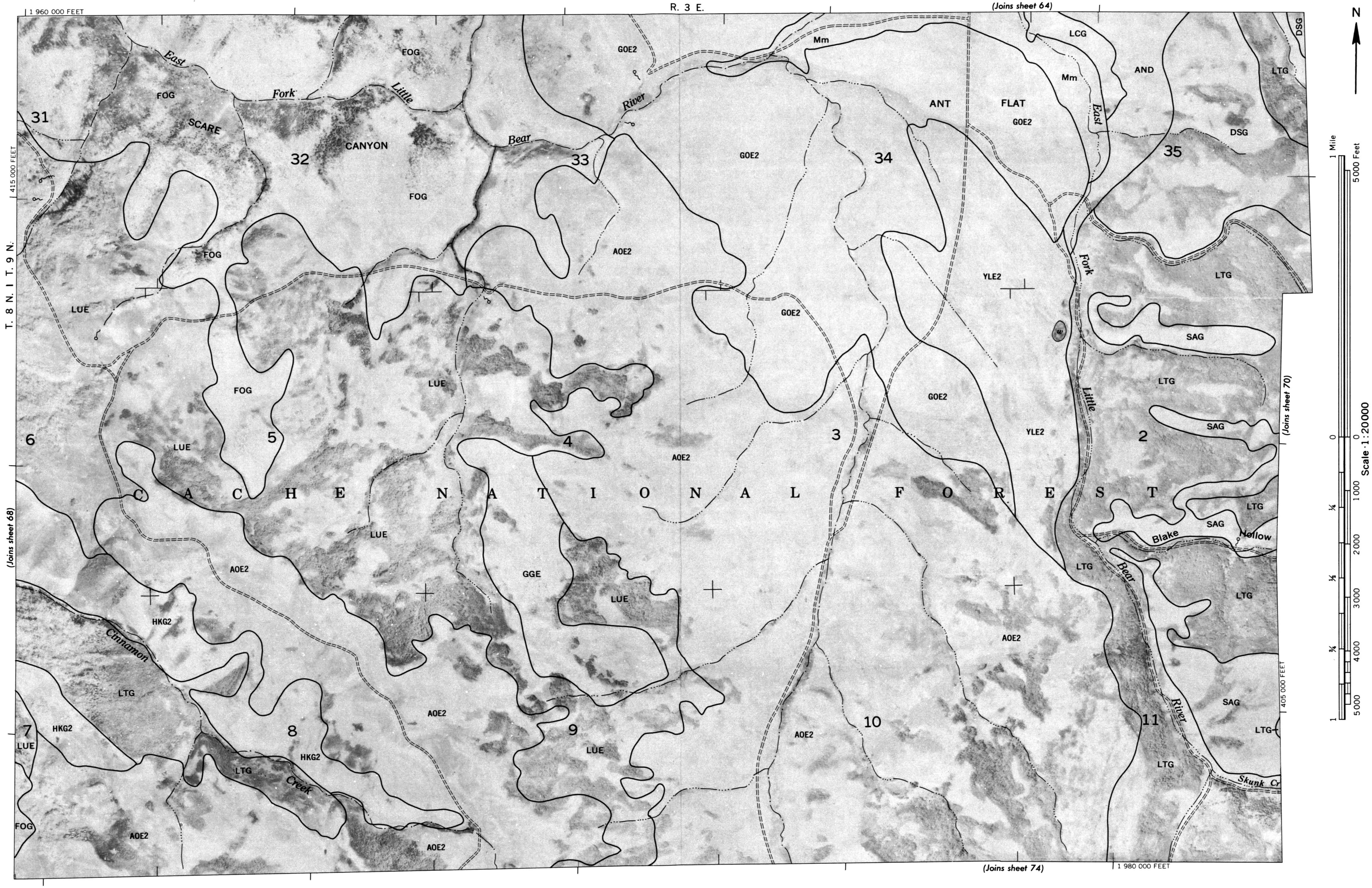
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

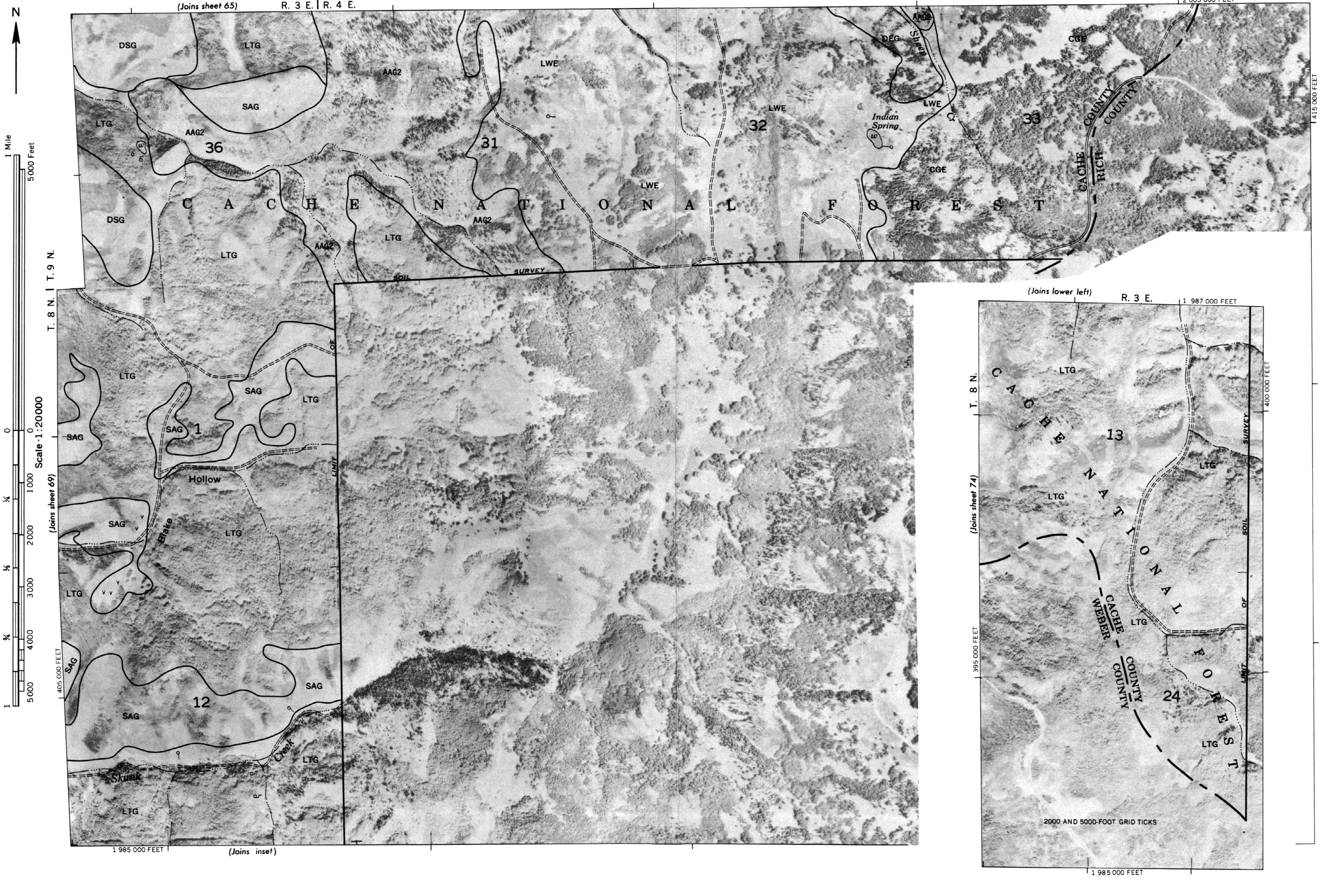
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 69

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 69



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 70



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 70

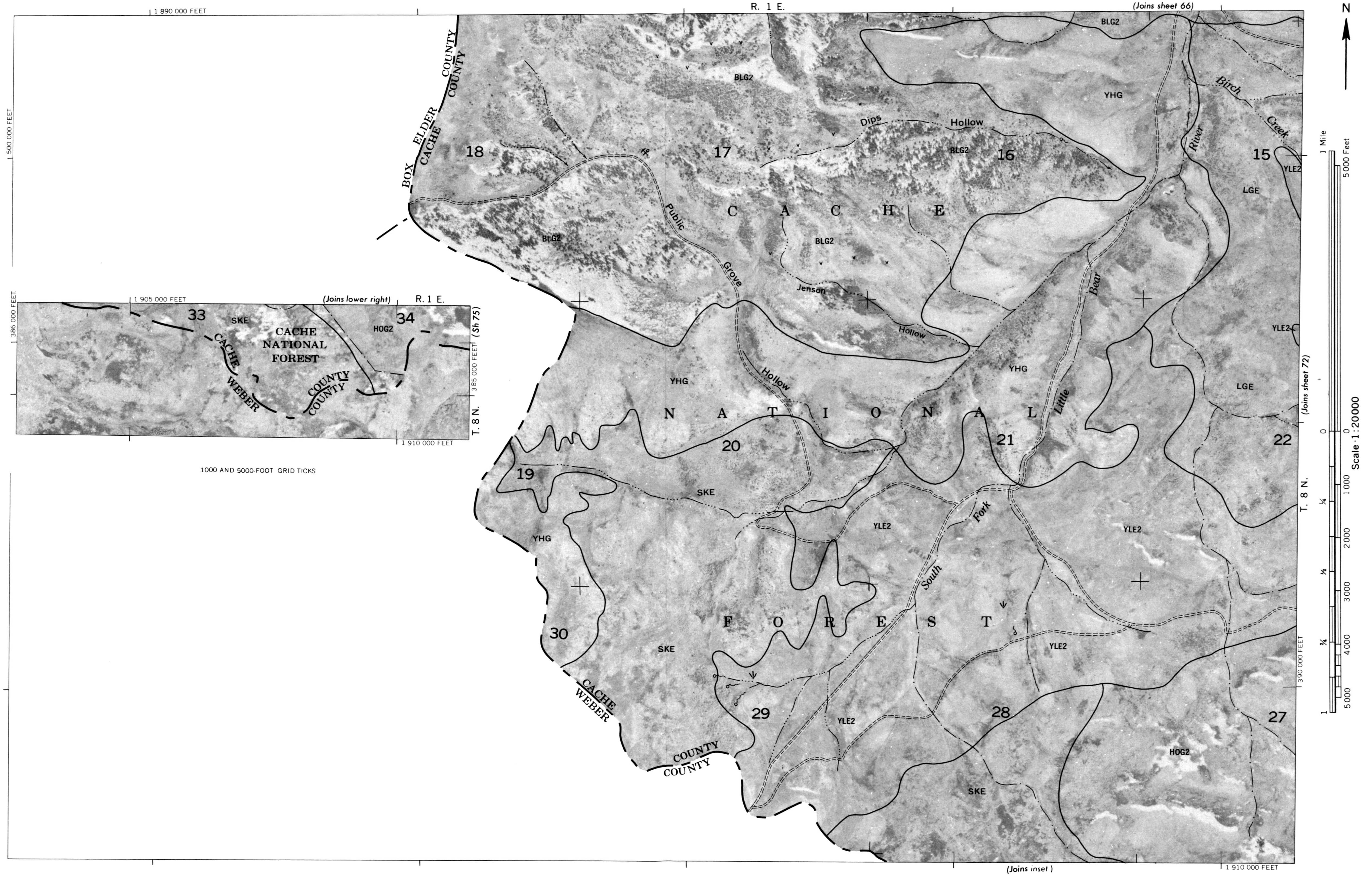
Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

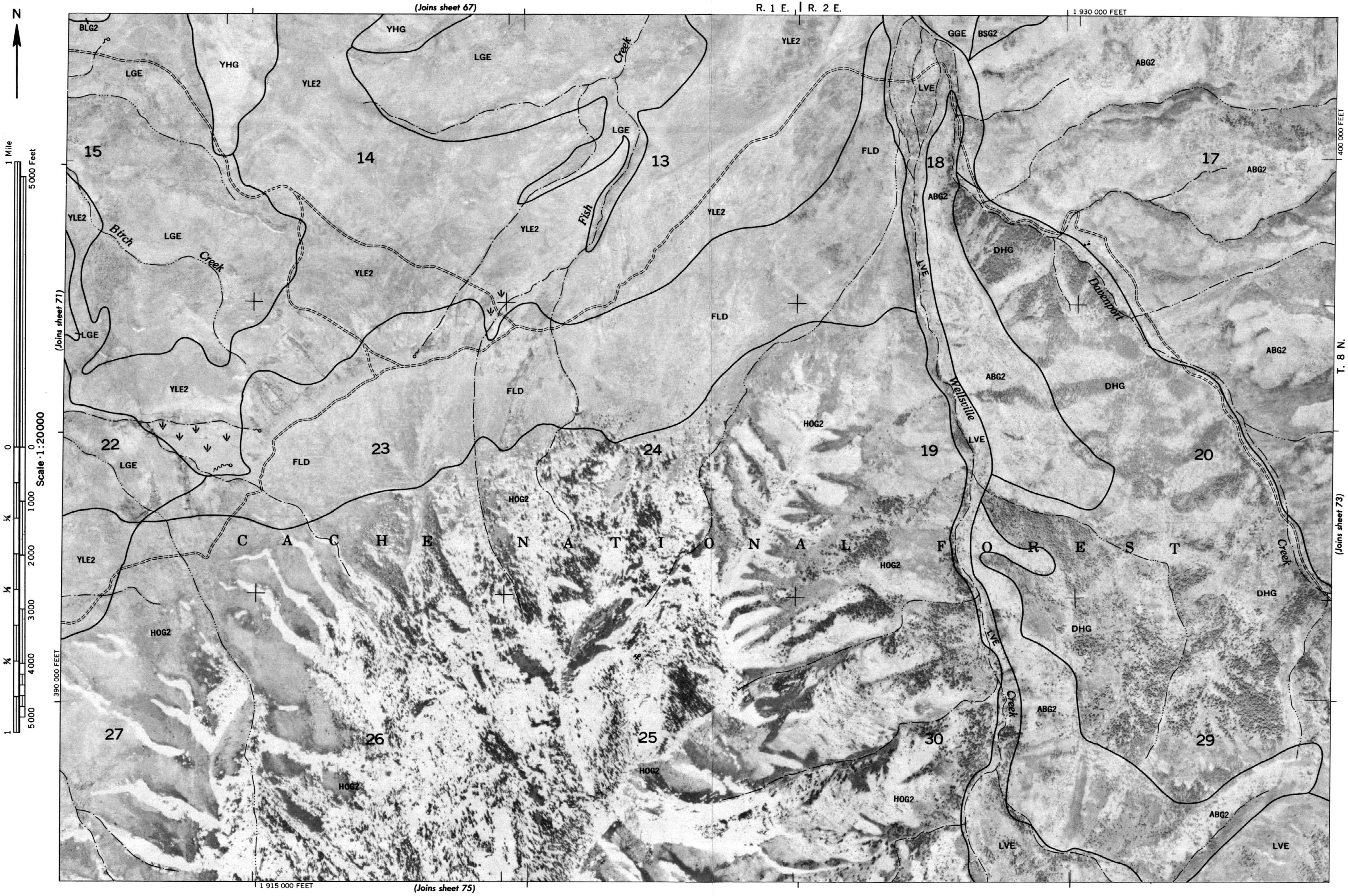
This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.
Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 71



72

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 72



CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 72

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

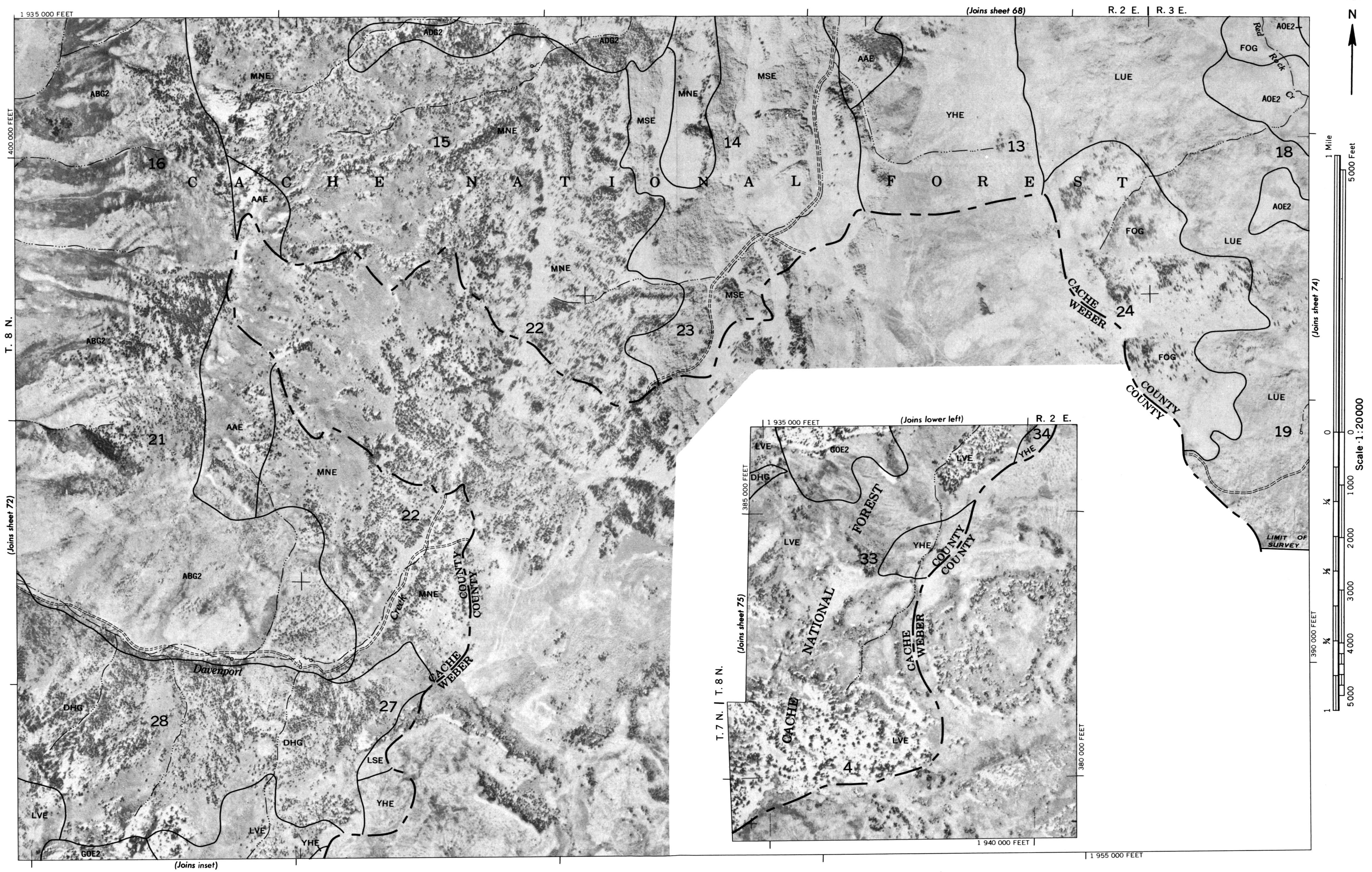
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 73

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone

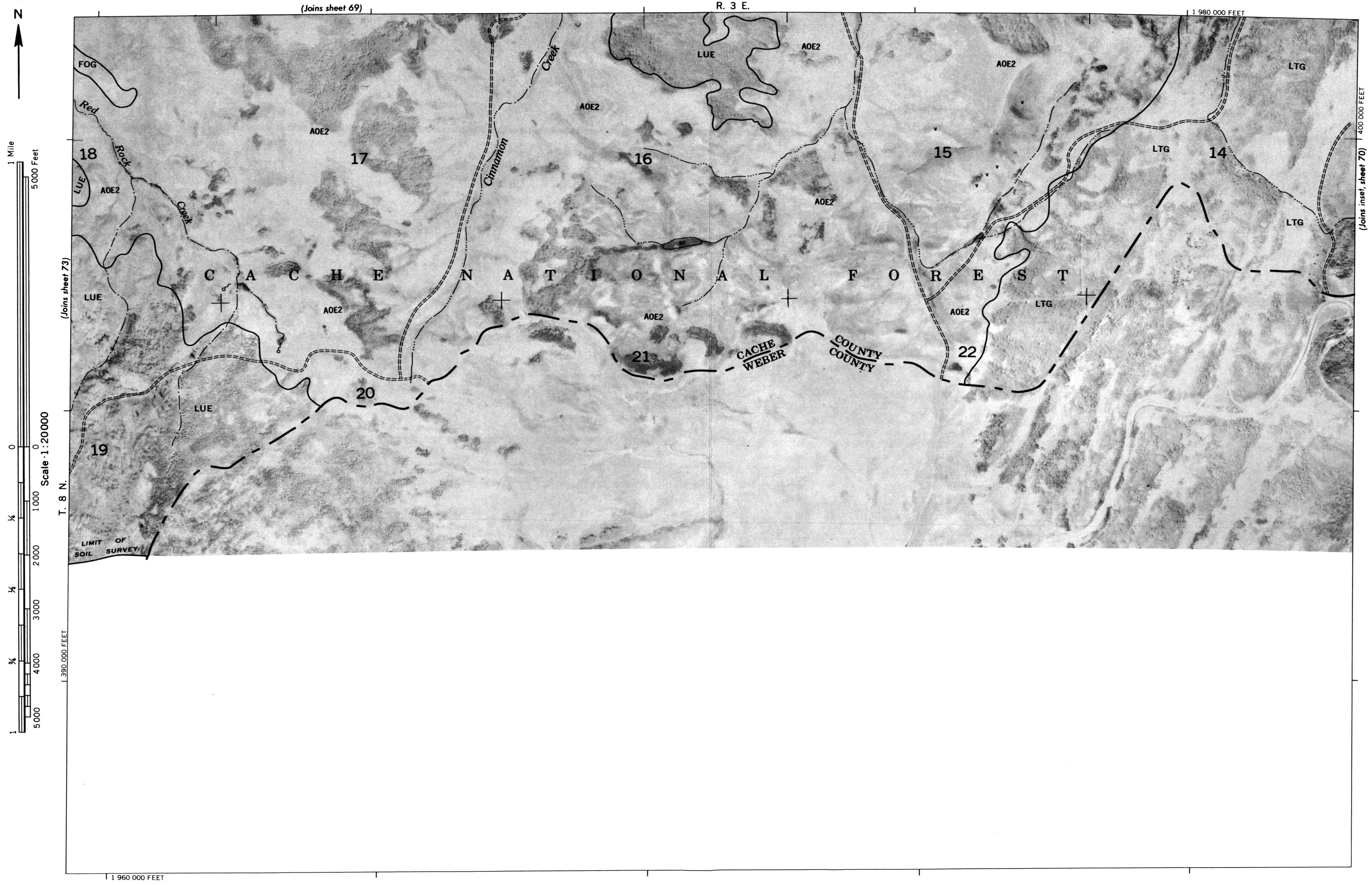
Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 73



(74)

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 74



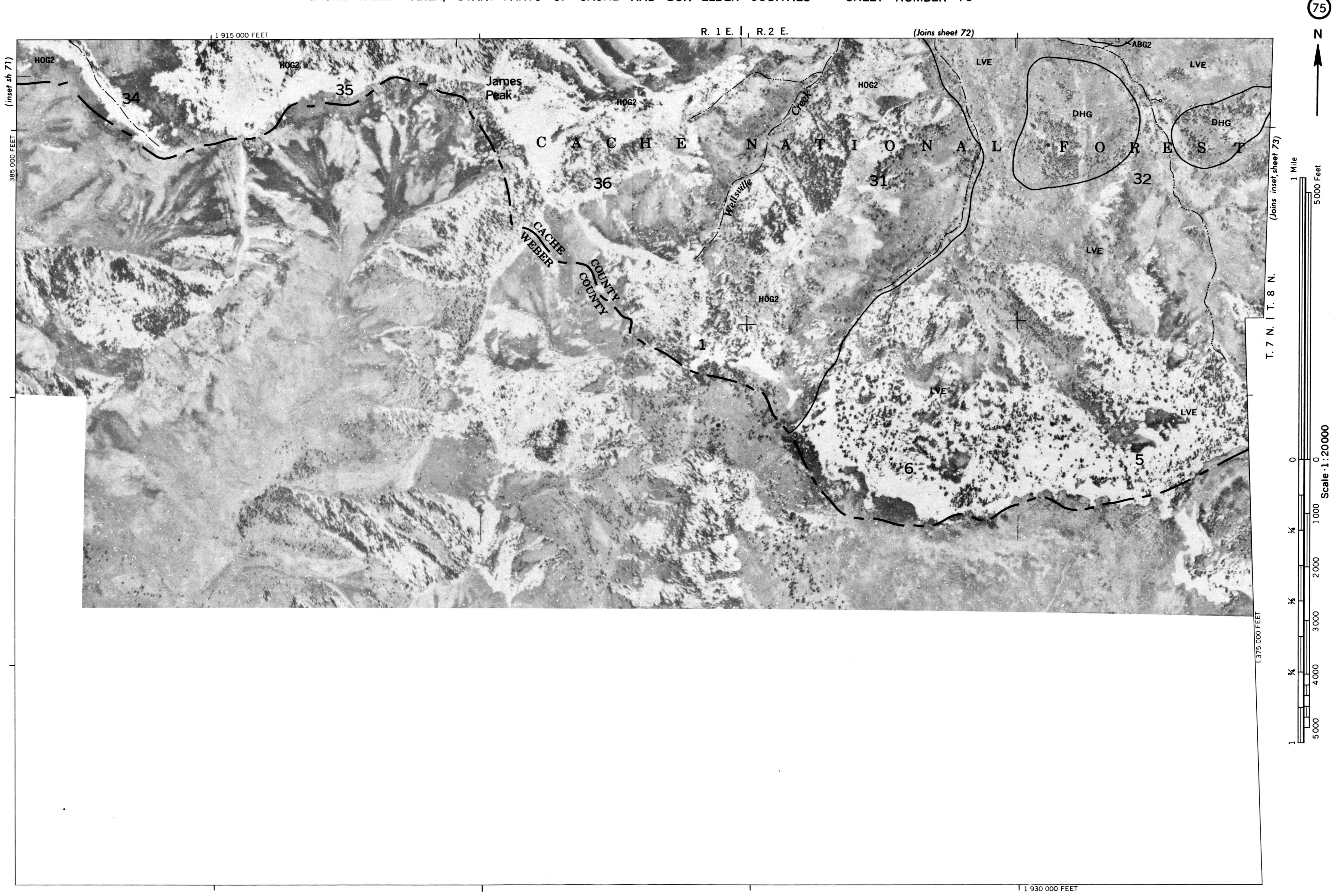
CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 74

Land division corners are approximately positioned on this map.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES — SHEET NUMBER 75



This map is one of a set compiled in 1971 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and Forest Service and the Utah Agricultural Experiment Station.

Photobase from 1963 and 1966 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the Utah coordinate system, north zone.

Land division corners are approximately positioned on this map.

CACHE VALLEY AREA, UTAH: PARTS OF CACHE AND BOX ELDER COUNTIES NO. 75